VOLUME 14 NUMBER 20 / OCTOBER 23, 1976

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-29152*# Sikorsky Aircraft, Stratford, Conn.
DERIVATION OF EQUATIONS OF MOTION FOR MULTIBLADE ROTORS EMPLOYING COUPLED MODES AND INCLUDING HIGH TWIST CAPABILITY
R. Sopher 27 Feb. 1975 295 p refs
(Contract NAS2-6463)
(NASA-CR-137898; SER-50912) Avail: NTIS HC $9.25 CSCL 01A

The derivation is described of the equations of motion for a multiblade rotor. The analysis advances on current capabilities for calculating rotor responses by introducing a high twist capability and coupled flatwise-edgewise assumed normal modes instead of uncoupled flatwise and edgewise assumed normal modes. The torsion mode is uncoupled as before. Features inherited from previous work include the support system models, consisting of complete helicopters in free flight, or grounded flexible supports, arbitrary rotor-induced inflow, and arbitrary vertical gust model. Author

N76-29153*# Sikorsky Aircraft, Stratford, Conn.
USER'S MANUAL FOR THE COUPLED MODE VERSION OF THE NORMAL MODES ROTOR AEROELASTIC ANALYSIS COMPUTER PROGRAM
Russell R. Bergquist, Raymond G. Carlson, A. J. Landgrebe, and T. A. Egolf [1974] 145 p refs
(Contract NAS2-6463)
(NASA-CR-137899; SER-50910) Avail: NTIS HC $6.00 CSCL 01A

This User's Manual was prepared to provide the engineer with the information required to run the coupled mode version of the Normal Modes Rotor Aeroelastic Analysis Computer Program. The manual provides a full set of instructions for running the program, including calculation of blade modes, calculations of variable induced velocity distribution and the calculation of the time history of the response for either a single blade or a complete rotor with an airframe (the latter with constant inflow). Author

N76-29154*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
DETERMINATION OF ORBITER AND CARRIER AERODYNAMIC COEFFICIENTS FROM LOAD CELL MEASUREMENTS
G. M. Glenn 22 Mar. 1976 30 p refs
(Contract NAS9-13970)
(NASA-CR-147846) Avail: NTIS HC $4.00 CSCL 01A

A method of determining orbiter and carrier total aerodynamic coefficients from load cell measurements is required to support the inert and the captive active flights of the ALT program. A set of equations expressing the orbiter and carrier total aerodynamic coefficients in terms of the load cell measurements, the sensed dynamics of the Boeing 747 (carrier) aircraft, and the relative geometry of the orbiter/carrier is derived. Author

N76-29155*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS FROM INVESTIGATIONS IN THREE NASA/LaRC HYPERSONIC WIND TUNNELS ON A .004 SCALE MODEL SPACE SHUTTLE ORBITER (MODEL 13P-O) TO DETERMINE REAL GAS EFFECTS (LA78, LA87, LA88)
J. W. Ball and G. W. Klug Jul. 1976 73 p
(Contract NAS9-13247)
(NASA-CR-147620; DMS-DR-2311) Avail: NTIS HC $4.50 CSCL 01A

Results from tests in the NASA/CF4, 20 inch Mach 6 and the 22 inch Helium Tunnel consist of pressure measurements on the lower surfaces of the Rockwell Space Shuttle Orbiter. All data are in absolute pressures. Data were recorded with the model at a Mach number of 6 and 20 at angles of 10 deg to 30 deg. Author

N76-29156*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF WING-TIP DIHEDRAL ON THE LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF A SUPERSONIC CRUISE CONFIGURATION AT SUBSONIC SPEEDS
Karen E. Washburn (Purdue Univ.) and Blair B. Gloss Aug. 1976 42 p refs
(NASA-TM-X-72693) Avail: NTIS HC $4.00 CSCL 01A

Force and moment data studies were conducted to determine the effect of wing-tip dihedral on the longitudinal and lateral aerodynamic characteristics of a supersonic cruise fighter configuration. Oil flow studies were also performed to investigate the model surface flow. Three models were tested: a flat (0 deg dihedral) wing tip, a dihedral, and an anhedral wing tip. The tests were conducted at the NASA Langley high-speed 7- by 10-foot wind tunnel. Author

N76-29157*# Wichita State Univ., Kans.
REFLECTION-PLANE TESTS OF SPOILERS ON AN ADVANCED TECHNOLOGY WING WITH A LARGE FOWLER FLAP
W. H. Wentz, Jr. and C. G. Volk, Jr. Washington NASA Jul. 1976 90 p refs
(Grant NsG-1118)
(NASA-CR-2696; WSU-AR-75-2) Avail: NTIS HC $5.00 CSCL 01A

Wind tunnel experiments were conducted to determine the effectiveness of spoilers applied to a finite-span wing which utilizes the GA(W)-1 airfoil section and a 30% chord full-span Fowler flap. A series of spoiler cross sectioned shapes were tested utilizing a reflection-plane model. Five-component force characteristics and hinge moment measurements were obtained. Results confirm earlier two-dimensional tests which showed that spoilers could provide large lift increments at any flap setting, and that spoiler control reversal tendencies could be eliminated by providing a vent path from lower surface to upper surface. Performance penalties due to spoiler leakage airflow were measured. Author

N76-29158*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
CALCULATION OF SUBSONIC AND SUPERSONIC STEADY AND UNSTEADY AERODYNAMIC FORCES USING VELOCITY POTENTIAL AERODYNAMIC ELEMENTS Final Report
John Kenneth Haviland and Young Sik Yoo Washington NASA Jul. 1976 190 p refs
(Grant NGL-47-005-098)
(NASA-CR-2695; ESS-4099-112-75) Avail: NTIS HC $7.50 CSCL 01A

Expressions for calculation of subsonic and supersonic, steady and unsteady aerodynamic forces are derived, using the concept of aerodynamic elements applied to the downwash velocity potential method. Aerodynamic elements can be of arbitrary out of plane polygon shape, although numerical calculations are restricted to rectangular elements, and to the steady state case in the supersonic examples. It is suggested that the use of conforming, in place of rectangular elements, would give better results. Agreement with results for subsonic oscillating T tails is fair, but results do not converge as the number of collocation points is increased. This appears to be due to the form of expression used in the calculations. The methods derived are expected to facilitate automated flutter analysis on the computer. In particular, the aerodynamic element concept is consistent with finite element methods already used for structural analysis. The method is universal for the complete Mach number range, and, finally, the calculations can be arranged so that they do not have to be repeated completely for every reduced frequency.
Author

N76-29159*# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
HOVER PERFORMANCE TESTS OF FULL SCALE VARIABLE GEOMETRY ROTORS
James B. Rorke Washington NASA Aug. 1976 18 p refs Sponsored in part by Army Air Mobility R and D Lab.
(Contract NAS1-12084; DA Proj. 1F1-62208-AH-76)
(NASA-CR-2713; SER-50954) Avail: NTIS HC $3.50 CSCL 01C

Full scale whirl tests were conducted to determine the effects of interblade spatial relationships and pitch variations on the hover performance and acoustic signature of a 6-blade main rotor system. The variable geometry rotor (VGR) variations from the conventional baseline were accomplished by: (1) shifting the axial position of alternate blades by one chord-length to form two tip path planes; and (2) varying the relative azimuthal spacing from the upper rotor to the lagging hover rotor in four increments from 25.2 degrees to 62.1 degrees. For each of these four configurations, the differential collective pitch between upper and lower rotors was set at + or - 1 deg, 0 deg and -1 deg. Hover performance data for all configurations were acquired at blade tip Mach numbers of 0.523 and 0.45. Acoustic data were recorded at all test conditions, but analyzed only at 0 deg differential pitch at the higher rotor speed. The VGR configurations tested demonstrated improvements in thrust at constant power as high as 6 percent. Reductions of 3 PNdb in perceived noise level and of 4 db in blade passage frequency noise level were achieved at the higher thrust levels. Consistent correlation exists between performance and acoustic improvements. For any given azimuth spacing, performance was consistently better for the differential pitch condition of + or - 1 degree, i.e. with the upper rotor pitch one degree higher than the lower rotor. Author

N76-29160*# Virginia Univ., Charlottesville.
DEVELOPMENT OF AN OPTIMAL AUTOMATIC CONTROL LAW AND FILTER ALGORITHM FOR STEEP GLIDESLOPE CAPTURE AND GLIDESLOPE TRACKING Final Report
Nesim Halyo Washington NASA Aug. 1976 94 p refs
(Contract NAS1-10210)
(NASA-CR-2720) Avail: NTIS HC $5.00 CSCL 17/7

A digital automatic control law to capture a steep glideslope and track the glideslope to a specified altitude is developed for the longitudinal/vertical dynamics of a CTOL aircraft using modern estimation and control techniques. The control law uses a constant gain Kalman filter to process guidance information from the microwave landing system, and acceleration from body mounted accelerometer data. The filter outputs navigation data and wind velocity estimates which are used in controlling the aircraft. Results from a digital simulation of the aircraft dynamics and the control law are presented for various wind conditions. Author

N76-29161# Transportation Systems Center, Cambridge, Mass.
JOINT US/UK VORTEX TRACKING PROGRAM AT HEATHROW INTERNATIONAL AIRPORT. VOLUME 1: EXECUTIVE SUMMARY Final Report, Apr. 1974 - Jan. 1976
J. N. Hallock and W. D. Wood Mar. 1976 34 p
(AD-A024842/7; DOT-TSC-FAA-76-11-Vol-1;
FAA-RD-76-58-Vol-1) Avail: NTIS HC $4.00 CSCL 21/2

From May 1974 through June 1975 the approach region to Runway 28R at Heathrow International Airport was equipped with aircraft wake vortex tracking equipment. The vortices from approximately 13,000 aircraft were monitored along with the attendant meteorological conditions. An overview of the Heathrow project is given, and it is shown how the project has significantly contributed to the capability to develop a vortex advisory system promising increased capacity through decreased aircraft separations. Author

N76-29162*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (0A148), VOLUME 1
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 828 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144619; DMS-DR-2254-Vol-1) Avail: NTIS HC $21.25 CSCL 01A

Data obtained in wind tunnel tests are presented. The objectives of the tests were to: (1) obtain pressure distributions, forces and moments over the vehicle 5 Orbiter in the terminal area energy management (TAEM) and approach phases of flight; (2) obtain elevon and rudder hinge moments in the TAEM and approach phases of flight; (3) obtain body flap and elevon loads for verification of loads balancing with integrated pressure distributions; and (4) obtain pressure distributions near the short OMS pods in the high subsonic, transonic and low supersonic Mach number regimes. Testing was conducted over a Mach number range from 0.6 to 1.4 with Reynolds number variations from 4.57 million to 2.74 million per foot. Model angle-of-attack was varied from -4 to 16 degrees and angles of side slip ranged from -8 to 8 degrees. Author

N76-29163*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (0A148), VOLUME 2
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 684 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144620; DMS-DR-2254-Vol-2) Avail: NTIS HC $16.25 CSCL 01A

For abstract, see Volume 1.

N76-29164*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME

INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (0A148), VOLUME 3

P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 789 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144621; DMS-DR-2254-Vol-3) Avail: NTIS HC $18.75 CSCL 01A

For abstract, see Volume 1.

N76-29165*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (0A148), VOLUME 4

P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 708 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144622; DMS-DR-2254-Vol-4) Avail: NTIS HC $18.75 CSCL 01A

For abstract, see Volume 1.

N76-29166*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STABILITY AND CONTROL CHARACTERISTICS OF AN AIR-BREATHING MISSILE CONFIGURATION HAVING A FORWARD LOCATED INLET

Wallace C. Sawyer and Clyde Hayes Washington NASA Jul. 1976 83 p refs
(NASA-TM-X-3391; L-10575) Avail: NTIS HC $5.00 CSCL 01A

An investigation was made to determine the aerodynamic characteristics of an airbreathing missile configuration having a forward located inlet. Control was provided by cruciform tail surfaces. Aerodynamic data were obtained for the body-tail configuration alone and with planar or cruciform wings. At Mach numbers from 2.86 to 4.63, the model had internal flow. At Mach numbers from 1.70 to 2.86, the internal duct was closed, and an inlet fairing was installed to simulate boost conditions. Author

N76-29167*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF WINGLETS ON THE STATIC AERODYNAMIC STABILITY CHARACTERISTICS OF A REPRESENTATIVE SECOND GENERATION JET TRANSPORT MODEL

Peter F. Jacobs and Stuart G. Flechner Washington NASA Jul. 1976 32 p refs
(NASA-TN-D-8267; L-10297) Avail: NTIS HC $4.00 CSCL 01A

A baseline wing and a version of the same wing fitted with winglets were tested. The longitudinal aerodynamic characteristics were determined through an angle-of-attack range from -1 deg to 10 deg at an angle of sideslip of 0 deg for Mach numbers of 0.750, 0.800, and 0.825. The lateral aerodynamic characteristics were determined through the same angle-of-attack range at fixed sideslip angles of 2.5 deg and 5 deg. Both configurations were investigated at Reynolds numbers of 13,000,000. per meter (4,000,000 per foot) and approximately 20,000,000 per meter (6,000,000 per foot). The winglet configuration showed slight increases over the baseline wing in static longitudinal and lateral aerodynamic stability throughout the test Mach number range for a model design lift coefficient of 0.53. Reynolds number variation had very little effect on stability. Author

N76-29168# Northrop Corp., Hawthorne, Calif. Aircraft Div.
UNSTEADY TWO-DIMENSIONAL SUBSONIC, TRANSONIC, AND SUPERSONIC FLOW CALCULATIONS BY THE METHOD OF CHARACTERISTICS Final Report, Mar. 1973 - Feb. 1976

C. W. Chu and S. Nadir Feb. 1976 81 p refs
(Contract N00014-73-C-0237; NR Proj. 061-213)
(AD-A021481; NOR-76-19) Avail: NTIS CSCL 20/4

A method of characteristics for calculating inviscid unsteady two-dimensional flow is presented. The compatibility relations for two-dimensional unsteady compressible flow are first derived and the boundary conditions are discussed. Then, the generalized finite-difference approximations of the compatibility relation are presented. This is followed by a description of the numerical scheme and some special procedures. Since the equations governing unsteady inviscid compressible flow are always hyperbolic, the method is applicable to subsonic, transonic, and supersonic flows, and the present scheme has been used to calculate flow fields over airfoils in all three speed regimes. Following the description of the numerical scheme and procedures, flow field examples in each of the three speed regimes are presented and discussed. Finally, conclusions are drawn and some future extensions are indicated. GRA

N76-29169# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
THE STRENGTH AND DEFORMATION ANALYSIS OF FLEXIBLE BALLOONS Final Report, 16 Oct. 1971 - 15 Oct. 1974

Harold Alexander May 1975 31 p refs
(Contract F19628-72-C-0100; AF Proj. 6665)
(AD-A021466; ME-RT-75007; AFCRL-TR-75-0351) Avail: NTIS CSCL 01/3

The Stevens Institute Laboratory for Balloon Technology was established in September, 1968 under the sponsorship of the Air Force Cambridge Research Laboratories. This report summarizes the activities of the past three years which include: recommendations for the military specification for polyethylene balloon films and the development of new testing methods, gore panel stress analysis of high altitude balloons, the qualification testing of candidate balloon films, and failure analysis and design consultation. The major accomplishments are outlined with references to appropriate scientific reports where the details are presented. Where this report constitutes the first formal reporting of results, the details are given. GRA

N76-29170# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AIRDROP ERROR ANALYSIS Final Report, Dec. 1973 - Aug. 1974

Gene A. Petry Jun. 1975 38 p refs
(AD-A020282; ASD-TR-75-8) Avail: NTIS CSCL 15/8

Current procedures that are used to determine the correct release point for airdrop are contained in the multi-command Air Force Manual 55-40, 'Computed Release System Procedures,' dated 4 November 1971. The dispersion of airdrop loads about the desired impact point that results when these procedures are used is much greater than desired. There are many factors affecting the air-drop dispersion. It is the objective of this report to identify those significant factors that contribute to the overall airdrop impact error and, where possible, recommend procedures for incorporating improvements. GRA

N76-29171# Naval Surface Weapons Center, White Oak, Md.
HANDBOOK OF INVISCID SPHERE-CONE FLOW FIELDS AND PRESSURE DISTRIBUTION, VOLUME 2

A. M. Morrison, J. M. Solomon, M. Ciment, and R. E. Ferguson 1 Dec. 1975 250 p
(SF3232250)
(AD-A021961; NSWC/WOL/TR-75-45-Vol-2) Avail: NTIS CSCL 20/4

This report contains numerical tables of aerodynamic coefficients and surface pressure distributions for sphere cone configurations as a function of angle of attack and Mach number. GRA

N76-29172# West Virginia Univ., Morgantown. Dept of Aerospace Engineering.
ASYMMETRIC ENTRAINMENT OF 2-D CURVED JETS

Subrato Chandra and John L. Loth Aug. 1975 196 p refs
(Contract N00014-73-A-0417-0003; NR Proj. 215-227)
(AD-A021967; TR-45) Avail: NTIS CSCL 01/3

The control of VTOL aircraft during transition from hover to forward flight is complicated by the lifting jet-airframe interaction. This analysis is concerned with the entrainment aspect of two dimensional thick curved jets. A realistic mathematical model of such jets should account for different entrainment rates and the

total pressure decay in the jet. The present theoretical analysis predicts curved jet characteristics needed for an accurate mathematical modelling of two dimensional lifting jets. The present analysis performs an integral method analysis of the curved jet using incompressible, fully turbulent, curved, free jet equations. Integral methods need specified jet edge velocity distributions. This streamwise velocity distribution depends on the airfoil geometry as well as on the jet. The present theory approximately retains this ellipticity by obtaining the streamwise jet edge velocities from a nonlinear iterative potential flow analysis of a thin jet issuing from the trailing edge of a hinged flat plate. The results of the present analysis are in agreement with available straight and curved jet results. The present theory predicts significantly (10%-20%) different entrainment rates near the exit where the curvature is maximum. Since V/STOL lift, moment, and pressure drag are significantly affected by the jet entrainment, one should incorporate the asymmetry of entrainment rates of curved thick jets in prediction methods. Author (GRA)

N76-29173# Raven Industries, Inc., Sioux Falls, S.Dak. Flight Operations Dept.
SKYHOOK 1975 Interim Report, 1 Mar. 1975 - 30 Jan. 1976
Tom Pappas and Homer E. Lee 30 Jan. 1976 100 p
(Contract N00014-75-C-1063; NR Proj. 211-197)
(AD-A022071; R-0176001) Avail: NTIS CSCL 01/3

The 1975 Skyhook program provided sufficient funding and balloons for eight flight attempts from Fort Churchill, Manitoba; Sioux Falls, South Dakota; and Salina, Kansas. Seven of these flights are considered successful launches although one balloon burst at ceiling. This report describes individual flights, equipment used, flight data, and various program information. Author (GRA)

N76-29174# Naval Civil Engineering Lab., Port Hueneme, Calif.
REDUCTION OF V/STOL DOWNWASH EFFECTS BY JET EXHUAST FLOW CONTROL Final Report, Jul. 1973 - Jun. 1974
D. E. Williams Dec. 1975 55 p refs
(SF53536001)
(AD-A021965; CEL-TN-1410) Avail: NTIS CSCL 01/3

The performance of V/STOL aircraft is influenced significantly by ground effects during landing and takeoff when the propulsive flow of the aircraft is directly downward. To mitigate downwash effects, a new landing mat concept was developed at Civil Engineering Laboratory whereby exhaust flow is controlled by either a very thin array of diamond patterns or parallel ribs. The impinging jet flow aligns itself with the long axis of the grid pattern, expanding in two directions along a single line rather than radially outward over the plane of the ground. Grid height or thickness is small compared with jet diameter. A method for calculating grid height was developed by combining Froessling's solution for boundary layer thickness and Glauert's solution for wall jet thickness. Author (GRA)

N76-29175# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN AERODYNAMIC INVESTIGATION OF A LOW ASPECT RATIO WING M.S. Thesis
Leonard V. McCommon Dec. 1975 126 p refs
(AF Proj. 1990)
(AD-A021733; GAE/AE/75D-15) Avail: NTIS CSCL 01/1

The study consisted of modeling and testing a high-speed, low aspect ratio flying wing (no conventional center body or fuselage) to determine its lift, drag, and static stability characteristics at Mach numbers of 0.70 to 0.86. Six different configurations of stabilizing fins were tested along with the basic finless configuration. Wind tunnel test results are presented in graphic and tabular form for use in further design studies. GRA

N76-29176# Northrop Corp., Hawthorne, Calif. Aircraft Div.
WAVE DRAG REDUCTION FOR AIRCRAFT FUSELAGES Interim Report
C. W. Chu, J. Der, Jr., and H. Ziegler Warminster, Pa. Naval Air Develop. Center Aug. 1975 78 p refs
(Contract N62269-74-C-0470)
(AD-A021718; NOR-75-70) Avail: NTIS CSCL 01/1

A numerical procedure has been developed to minimize the wave drag of a forward aircraft fuselage and canopy configuration subject to realistic constraints imposed by design requirements. The procedure makes use of the Latin Square sampling technique and the Three-Dimensional Method of Characteristics. The former is used to efficiently sample the family of configurations, and the latter is used to accurately calculate the wave drags of the sampled configurations. The calculated wave drag coefficients are then used to derive a functional dependence of the wave drag on the geometric variables that define the family of configurations. The minimum wave drag configuration can be obtained by minimizing the wave drag function subject to a given set of constraints. A new concept which enables the minimizing procedure to improve by 'learning' from experience is presented. This concept proves very useful and can be applied to other optimization procedures using Latin Square sampling. Finally, the wave drag reduction procedure is demonstrated using the F-4 fuselage as the baseline. The results are presented and discussed. Author (GRA)

N76-29177# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
ON LIFTING-LINE THEORY IN UNSTEADY AERODYNAMICS
H. K. Cheng Jan. 1976 28 p refs
(Contract N00014-75-C-0520; NR Proj. 061-192)
(AD-A021449; USCAE-133) Avail: NTIS CSCL 01/1

This paper presents a linear theory of a high-aspect-ratio planar wing with a curved center line undergoing unsteady motion in an incompressible flow with a uniform freestream. Five distinct frequency ranges are identified. Except in the low-frequency range where the wave length is comparable to the wing span, matched inner and exterior solutions are obtained. The significance of the induced upwash due to sweep, and the usefulness of the center-line curvature in mitigating this upwash effect, are explained. The theory provides a basic framework wherein the lunate-tail problem in aquatic animal propulsion can be studied. GRA

N76-29178# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
LIFTING JET FLOW FIELDS Final Contract Report
J. L. Loth, Richard E. Walters, and Subrato Chandra Aug. 1975 51 p refs
(Contract N00014-73-A-0417-0003; NR Proj. 215-227)
(AD-A021968; TR-46) Avail: NTIS CSCL 01/3

The control of VTOL aircraft during transition from hover to forward flight is complicated due to the complex airframe-jet interaction. This investigation is concerned with mathematical modelling of asymmetric entrainment of lifting jets. The analysis is for two dimensional augmenters used on VTOL aircraft. The theoretical analysis of the lifting jets was limited to two dimensional curved jets in forward flight and out of ground effects. The aim was to predict the asymmetric entrainment rates of the curved jet along with its decay rate of the maximum velocity, and jet width growth rate. The results were obtained using turbulent curved free jet theory in conjunction with thin jet potential flow models to obtain the jet edge streamwise velocities. To test the effects of asymmetric entrainment the results were inserted in a thick jet potential flow computer program to obtain transition flight performance of a typical VTOL augmenter wing. A concurrent experimental study was undertaken to determine curved jet characteristics issuing from a two dimensional model. Maximum velocity decay, jet curvature, jet width, velocity and pressure profiles were measured. Good agreement has been obtained between the theoretical predicted and experimental measured curved jet characteristics. It was necessary to adjust the constant in the turbulent shear stress model to get this good agreement. Both experiments on the straight and curved jets at West Virginia University and by others have been compared with the theory. GRA

N76-29179# Naval Postgraduate School, Monterey, Calif.
IN-LINE FORCES ACTING ON SMOOTH CYLINDERS IN HARMONIC FLOW M.S. Thesis
Savas Onur Dec. 1975 51 p refs
(AD-A021830) Avail: NTIS CSCL 20/4

The in-line force acting on smooth circular cylinders placed in oscillatory flow has been measured using a recently constructed U-tunnel. The drag and inertia coefficients have been determined

through the use of the Fourier analysis and found to depend on Reynolds number as well as Keulegan-Carpenter number for Reynolds numbers about greater than 25,000. A new parameter namely the 'Frequency Parameter' has been defined as the ratio of the Reynolds number to the Keulegan-Carpenter number, and the existence of unique relations between frequency parameter and the drag and inertia coefficients have been shown. It is recommended that the experiments be extended to even larger Reynolds numbers using the same experimental technique and apparatus. GRA

N76-29180# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE DRAG ON A CIRCULAR CYLINDER AND CURVED SHELL IN TRANSONIC FLOW M.S. Thesis
Steve Borah Dec. 1975 86 p refs
(AD-A021874; GAE/AE/75D-8) Avail: NTIS CSCL 20/4

This study was one in a series by the Air Force Flight Dynamics Laboratory in large turret aerodynamic research. The objective of the study was the reduction of transonic drag of a particular turret configuration by the addition of area rule fairings. Wind tunnel models were tested at transonic Mach numbers from 0.6 to 0.9. An internally mounted force balance and unsteady pressure transducers were used to measure the forces and pressure variations on the model. Fairings were placed beside and aft of the turret in an effort to reduce the transonic turret drag. The least drag configuration was a single fairing mounted behind the turret. This design had as much as a 55% drag reduction from the bare turret. This model also created the smallest pressure fluctuations in a circular cavity in the side of the turret. GRA

N76-29181# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ON THE POTENTIAL FLOW ABOUT AN AIRFOIL IN GROUND EFFECT AND UNDERGOING UNSTEADY MOTION Final Report
Robert A. Golobic Dec. 1975 43 p refs
(AF Proj. 7905)
(AD-A021749; SRL-TR-75-0021) Avail: NTIS CSCL 20/4

A computer solution employing Pistólesi's theorem and the method of images has been developed to determine the potential flow about an airfoil in ground effect undergoing unsteady motion. The airfoil mean camber line is broken into a finite number of straight line segments. Vortices are used to model the airfoil potential and the wake potential. Although the solution is restricted to thin airfoils, it is not restricted to small angles of attack or small camber. Solutions of an airfoil undergoing harmonic motion and a C-130 short take-off maneuver are presented. GRA

N76-29182# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
MIXING DUCT PRESSURE DISTRIBUTIONS AND EXHAUST FLOW CHARACTERISTICS OF A HIGH TEMPERATURE AND PRESSURE CYLINDRICAL EJECTOR Interim Technical Report, Jun. 1973 - May 1974
Brian Quinn and Howard L. Toms, Jr. Jun. 1975 95 p refs
(AF Proj. 7116)
(AD-A021626; ARL-75-0227) Avail: NTIS CSCL 01/3

The thermodynamic and mixing characteristics of a family of inlet area ratio 26 ejectors have been measured across a range of primary reservoir pressures (0 to 80 psig) and temperatures (65 to 1,000 F). The length-to-duct diameter ratio of the ejectors was the family parameter and varied from 12.36 to 3.46. The distribution of pressure along the wall of the mixing duct clearly identified up to three distinct modes of turbulent mixing. They also substantiated prior observations that mixing is accelerated by heating the primary jet. The discrete modes of mixing were subjectively related to the acoustic properties of the greatly underexpanded primary nozzle. GRA

N76-29183# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EXPERIMENTAL DETERMINATION OF LIFT AND DRAG FOR COANDA YAW THRUSTER M.S. Thesis
Neil R. Cole Dec. 1975 110 p
(AD-A021873; GAE/AE/75D-11) Avail: NTIS CSCL 01/3

Lift and drag forces produced by a 35% scale model of a yaw thruster device employing the Coanda effect were experimentally measured using 'fish type' spring scales. The device tested was a model of a prototype being considered for maneuvering a remotely piloted vehicle equipped with an Air Cushion Landing System while it is on the ground. Tests were conducted using cold air flow at an average pressure ratio of 1.073, a temperature between 35 C and 45 C, and a mass flow rate of about 3.1 lbm/sec. The effects of changing the mounting position and angle of the yaw thruster were also investigated. The radial position was varied from touching the exhaust nozzle to 0.3 in. and the horizontal position from at the exhaust nozzle exit plane to 0.74 in. The thruster mounting angle was varied from 6 degrees to 14 degrees. The optimum performance position of the yaw thruster was determined to be at a radial distance of 0.2 in., a horizontal distance of 0.23 in., and a mounting angle of 12 degrees. For this position the lift was 0.92 lb and the drag 0.75 lb. Flow visualization testing revealed a complex flow field over the thruster surface and separation of the flow for all positions tested. GRA

N76-29184# ARO, Inc., Arnold Air Force Station, Tenn.
INFLUENCES OF STING SUPPORT ON AERODYNAMIC LOADS ACTING ON CAPTIVE STORE MODELS Final Report, Apr. 1973 - Jun. 1975
R. E. Dix AEDC Mar. 1976 329 p refs
(AF Proj. 2567)
(AD-A022257; ARO-PWT-TR-75-95; AEDC-TR-76-1; AFATL-TR-76-25) Avail: NTIS CSCL 01/1

In a series of wind tunnel tests, measurements were made of the aerodynamic loads acting on eight different store configurations mounted in the external captive position on a one-twentieth-scale model of the F-4C aircraft. Store models included blunt and contoured afterbody shapes, stable and unstable designs, and large (one per pylon) and small (rack-mounted) configurations. The tests were conducted in an effort to evaluate sting effects on captive store loads. Sting effects were considered to consist of two contributions: the effect of altering the afterbody of a store to allow insertion of a sting, and the effect of the presence of the sting. Altering the afterbody of an unstable store influenced captive loads less than altering a stable configuration. It was also determined that the presence of a sting affected most the pitching and yawing moments. GRA

N76-29185# ARO, Inc., Arnold Air Force Station, Tenn.
STATUS REPORT ON THE CALCULATION OF BLUNT BODY FLOW FIELDS IN SUPERSONIC, NONUNIFORM FLOWS Final Report, 1 Jul. 1974 - 30 Jun. 1975
Harold J. Schmidt AEDC Mar. 1976 38 p refs
(ARO Proj. P33A-36A)
(AD-A022033; ARO-PWT-TR-75-109; AEDC-TR-76-31) Avail: NTIS CSCL 20/4

It is difficult to eliminate flow nonuniformities in facilities for the testing of ablative heat shield materials. To investigate the potential effects of free-stream nonuniformities, a modification of an existing analytical method developed by Moretti and co-workers for uniform blunt body flows has been used. The results of the study indicate that for the flow model used, the free-stream nonuniformity can significantly alter the flow properties of the body surface. In particular, free-stream Mach number gradients can result in velocity gradients at the body surface which, in turn, will influence local heating rates. Author (GRA)

N76-29257* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASYMMETRIC AERODYNAMIC FORCES ON AIRCRAFT AT HIGH ANGLES OF ATTACK - SOME DESIGN GUIDES
Gary T. Chapman, Earl R. Keener, and Gerald N. Malcolm *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p refs (For availability see N76-29245 20-08)
CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-29186# Federal Aviation Administration, Washington, D.C.
RATIONALE FOR IMPROVING THE PROTECTION AGAINST MID-AIR COLLISIONS. VOLUME 2: MAIN TEXT Final Report
David R. Israel et al Nov. 1975 155 p
(AD-A024544/9; FAA-ED-75-1-Vol-2) Avail: NTIS HC $6.75 CSCL 01/2

Charts and viewgraphs illustrating the concepts, and hardware tests that have been conducted by the government and private industry in an attempt to provide the maximum protection against midair collisions for all classes of aircraft at minimum cost are investigated. A logical evolution to the Beacon Derived Collision Avoidance System (BCAS) and Intermittent Positive Control (IPC) as the most cost effective solutions to the midair collision problems is discussed with a statement of current concepts and programs being implemented to realize the potential benefits of the BCAS and IPC systems. Additional procedural and regulatory actions are also considered. Author

N76-29187# Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCED TECHNIQUES IN CRASH IMPACT PROTECTION AND EMERGENCY EGRESS FROM AIR TRANSPORT AIRCRAFT
R. G. Snyder (Michigan Univ., Ann Arbor) Jun. 1976 320 p refs
(AGARD-AG-221; AGARDograph-221; ISBN-92-835-1218-9) Copyright. Avail: NTIS

Analysis of all NATO member air transport accidents, 1964-1975, revealed that injuries and fatalities, when such information could be determined, were primarily due to the post-crash effects of fire, smoke and toxic fumes, and secondarily to crash impact. Future air transport design trends were reviewed, and approximately 150 advanced crash-impact and emergency-egress concepts, devices, and state-of-the-art techniques were evaluated. These included occupant restraints, smoke hoods, aisle and egress emergency lighting, passenger warning systems, escape slides and devices, heat shields, high-energy emergency egress systems, and emergency inflight egress systems. It was concluded that rear-facing passenger seats, the NASA Ames (21+6 sub x sub 45+6 sub z) airline seat, and the production sheldahl smoke hood can provide significantly improved occupant protection, while high-energy emergency egress systems appear promising for future aircraft. More research is needed to improve passenger warning and public address systems. Concepts of emergency inflight egress are not yet feasible, although technically within the state-of-the-art. Author

N76-29188*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF SHORT-HAUL AIRCRAFT OPERATING ECONOMICS. PHASE 2: AN ANALYSIS OF THE IMPACT OF JET MODERNIZATION ON LOCAL SERVICE AIRLINE OPERATING COSTS Final Report
Donald A. Andrastek May 1976 155 p refs
(Contract NAS2-8549)
(NASA-CR-137863; MDC-J7245) Avail: NTIS HC $6.75 CSCL 05C

The objectives of this phase of the study were (1) to assess the 10 year operating cost trends of the local service airlines operating in the 1965 through 1974 period, (2) to glean from these trends the technological and operational parameters which were impacted most significantly by the transition to newer pure jet, short haul transports, and effected by changing fuel prices and cost of living indices, and (3) to develop, construct, and evaluate an operating cost forecasting model which would incorporate those factors which best predicted airline total operating cost behavior over that 10-year period. Author

N76-29189# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
QF-4 B AIRCRAFT TARGET FINAL SHOP CHECKOUT PROCEDURE
J. J. Cary 27 Nov. 1974 152 p refs
(AD-A021310; NADC-73206-30) Avail: NTIS CSCL 01/3

A step-by-step procedure for performing a complete checkout and final adjustment of a newly converted QF-4B aircraft target is presented. Author (GRA)

N76-29190# Department of Transportation, Washington, D.C.
THE SECRETARY'S DECISION ON CONCORDE SUPERSONIC TRANSPORT
4 Feb. 1976 99 p refs
(AD-A022340) Avail: NTIS CSCL 01/2

It has been decided to permit British Airways and Air France to conduct limited scheduled commercial flights into the United States for a trial period not to exceed 16 months under certain limitations and restrictions. It has been decided also to proceed with a proposed high altitude pollution program (HAPP), to produce the data base necessary for the development of national and international regulation of aircraft operations in the stratosphere. GRA

N76-29191# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
US GENERAL AVIATION TAKEOFF ACCIDENTS: THE ROLE OF PREFLIGHT PREPARATION
10 Mar. 1976 30 p
(PB-252203/3; NTSB-AAS-76-2) Avail: NTIS HC $4.00 CSCL 01B

The report analyzes general aviation takeoff accidents which occurred in 1974, with special emphasis on the involvement of preflight planning. The most frequently referenced cause/factors in takeoff accidents are discussed in relation to the type certificate held by the pilot. Factors to consider during preflight preparation are included. From these discussions, remedial measures to reduce the number of takeoff accidents were formulated. GRA

N76-29192# Department of Transportation, Washington, D.C. Office of Transportation Regulatory Policy.
AIR SERVICE TO SMALL COMMUNITIES Final Report
Peyton L. Wynns Mar. 1976 141 p refs
(PB-251498/2) Avail: NTIS HC $6.00 CSCL 01B

Since 1960 regulated air carriers have been discontinuing service to small communities. There seems little likelihood that the trend will be reversed. The move by regulated airlines toward larger jets makes regulated service to small communities increasingly uneconomic. Fortunately, commuter airlines are filling the gap. They are not subject to CAB rate and route regulation but do meet FAA safety requirements. Commuter airline service to small communities is studied. One of the conclusions is that operating without subsidies, commuters have become the fastest growing segment of air transport. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N76-29193# IIT Research Inst., Annapolis, Md.
FAA VHF AIR/GROUND DATA LINK AND FLIGHT SERVICE SYSTEM COMMUNICATIONS ANALYSIS Final Report
Frank Atwell Mar. 1976 33 p Sponsored by FAA and DOD
(AD-A024371/7; ECAC-PR-76-014; FAA-RD-76-38) Avail: NTIS HC $4.00 CSCL 17/7

The procedures and rationale used to produce overlays which depict line-of-sight coverage diagrams for Federal Aviation Administration (FAA) sites within the conterminous United States and Print-outs which indicate minimum reception altitudes for

selected areas are presented. The overlays and diagrams were submitted to the FAA in support of its Air/Ground Data Link and Flight Service System modernization programs. Author

N76-29194# Airborne Instruments Lab., Deer Park, N.Y.
ILS SCALE MODEL FACILITY Final Report, Sep. 1973 - Dec. 1975
A. S. Palatnick and C. Creedon Jan. 1976 49 p
(Contract DOT-FA74WA-3345)
(AD-A024486/3; FSG-A414-4; FAA-RD-76-36) Avail: NTIS HC $4.50 CSCL 01/2

The design, installation, and testing of an instrument landing systems scale model facility are described. The model system consists of a localizer, glide slope, and automatic tracking facilities, with a scale factor of 30/1. The facility provides course structure deviations of less than plus or minus 5 uamps and plus or minus 2 uamps from theoretical for glide slope and localizer respectively from the outer marker to threshold. Author

N76-29195# TRW Systems, Redondo Beach, Calif.
ENROUTE AIR TRAFFIC CONTROL PROGRAM SOFTWARE OPTIMIZATION STUDY Final Report
David D. Morrison, Bruce K. Richard, Mary Parmenter, Britta Lindgren, Ivin Tarnove, Candace Anthony, and Ed Frye Jun. 1975 377 p
(Contract DOT-FA74WA-3458)
(AD-A024372/5; TRW-25629.000; FAA-RD-75-88) Avail: NTIS HC $10.75 CSCL 17/7

The NAS Enroute computer program was studied to determine the efficiency of the current code and to suggest ways of improving the program. The problem was divided into several areas to study improvement in the Monitor, the data base, the mathematical algorithms, the program structure, and local code optimization. The results indicated that the program can be significantly improved. In another part of the study a typical program segment was selected, redesigned, and recoded. The redesigned program was smaller, simpler, faster, and more accurate. The recommendation of the study is that the NAS program be completely redeveloped. If this is not done, it is recommended to improve the program by redeveloping large program segments and redesigning portions of the data base. Lesser improvements can be made by structural changes, local code optimization, and documentation improvements. Author

N76-29196# Mitre Corp., Atlantic City, N.J.
INTERFACE DEFINITION DABS ENGINEERING MODEL/ ATC (NAFEC) DIGITAL SIMULATION FACILITY DATA FORMATS, VOLUME 2, SERIES 3
Royal A. Westcott Dec. 1975 83 p refs
(Contract DOT-FA69NS-162)
(AD-A025233/8; MTR-4221-Vol-2-Ser-3; FAA-RD-74-159-Vol-2-Ser-3) Avail: NTIS HC $5.00 CSCL 17/7

The formats are described of the simulated surveillance and communications messages for the interface between the Digital Simulation Facility (DSF) and the Air Traffic Control (ATC) facilities at NAFEC. The facilities which will be interfaced with the DSF are the NAS Enroute System in the System Support Facility (SSF) and the ARTS 3 System in the Terminal Automation Test Facility (TATF). These interfaces will be made available for use for IPC Phase 2 testing and other advanced ATC system test activities requiring the simulation of the Discrete Address Beacon System in the DSF. Author

N76-29197# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MLS MULTIPATH STUDIES. VOLUME 2: APPLICATION OF MULTIPATH MODEL TO KEY MLS PERFORMANCE ISSUES Technical Report, Mar. 1974 - 30 Sept. 1975
J. E. Evans, R. B. Burchsted, J. Capon, R. S. Orr, D. A. Shnidman, and S. M. Sussman 25 Feb. 1976 172 p refs
(Contracts DOT-FA74WAI-461; F19628-76-C-0002)
(AD-A025108/2; ATC-63-Vol-2; FAA-RD-76-3-Vol-2) Avail: NTIS HC $7.50 CSCL 01/2

The development of realistic models for (1) the multipath in representative real world environments, and (2) the multipath characteristic of candidate Microwave Landing Systems (MLS) techniques is described. These multipath and system models are used in a comprehensive computer simulation to predict the strengths and weaknesses of major MLS systems when subjected to representative real world environments. Mathematical models are given for the major MLS multipath sources (ground reflections, building and aircraft reflections, and shadowing by objects and humped runways), and it is shown that they agree well with field data (including the Lincoln measurements at Logan Airport). Models for the techniques (Doppler and scanning beam) considered in phase II of the U. S. MLS program are presented together with validation by comparison with theory and bench tests. Also presented are the results of a general study in motion averaging. The (validated) computer simulation (and portions thereof) is applied to studying (1) the critical areas required by the TRSB system to avoid excessive reflection effects, (2) the expected TRSB performance with vertical polarization and benefits that might be derived with an alternative polarization, and (3) siting of a specific TRSB system at Friendship International Airport. Author

N76-29198# Quinby (Gilbert F.), Fort Washington, Pa.
UPGRADED THIRD GENERATION (UG 3D) AIR TRAFFIC CONTROL SYSTEM. IMPRESSIONS AND IMPACT ON GENERAL AVIATION Final Report
Gilbert F. Quinby Apr. 1976 50 p Sponsored by FAA
(AD-A025236/1; FAA-RD-76-81) Avail: NTIS HC $4.50 CSCL 01/2

Interviews were conducted with seven organizations on the subject of the functions and characteristics of the ATC system, particularly in those areas of serious interest to system users. With a few exceptions, such as the need for improved weather detection and reporting and other flight services, it appeared that the provisions of the existing generation of Air Traffic Control is reasonably adequate to the present requirements. A series of matrices showing the degree of importance attached by each segment interviewed to each of the major elements is included. Author

N76-29199# IIT Research Inst., Annapolis, Md.
INTERFERENCE POTENTIAL OF THE DISCRETE ADDRESS BEACON SYSTEM (DABS) PROVISIONAL SIGNAL FORMATS ON X AND Y MODE TACAN EQUIPMENTS Final Report
James L. Wingard Dec. 1975 111 p Sponsored in part by DOD
(Contract DOT-FA70WAI-175; Proj. 034-620-01)
(AD-A025205/6; ECAC-PR-75-027; FAA-RD-75-109) Avail: NTIS HC $5.50 CSCL 17/7

The interference potential of the Discrete Address Beacon System (DABS) signal formats is investigated. Interference effects of the DABS signal are described in terms of: (1) average DABS signal level received by an interrogator, relative to the maximum interference level, several of which can be tolerated by the interrogator; and (2) the percent of deadtime and loading generated by the beacon as a result of DABS interference. A set of minimum frequency distance separations that would limit the impact of DABS signal formats on the performance of equipment is developed. Author

N76-29200# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: CIRCUIT MODIFICATIONS FOR MARK 3 INSTRUMENT LANDING SYSTEM TO PREVENT OPERATIONAL UPSETS DUE TO ELECTRICAL TRANSIENTS ON CABLES Final Report, 15 Aug. 1975 - 1 Feb. 1976
Gene K. Huddleston Feb. 1976 195 p refs
(Contract DOT-FA72WAI-356)
(AD-A024548/0; FAA-RD-76-61) Avail: NTIS HC $6.00 CSCL 17/7

The circuits of the Mark 3 Instrument Landing System which are susceptible to false actuation due to electrical transients on interconnecting electrical cables are identified. The effects of the transients on system operating are analyzed, and the circuit modifications required to prevent operational upsets due to transients are presented. The points of entry of surges on ac power lines in the system are identified. Author

N76-29201# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN ANNOTATED COMPILATION OF NAFEC VISUAL AID

LETTER AND DATA REPORTS, 1971-1975 Final Report, Nov. 1971 - Apr. 1975
E. Leon Reamer May 1976 78 p ref
(AD-A025237/9; FAA-NA-75-69; FAA-RD-76-74) Avail: NTIS HC $5.00 CSCL 01/5

Federal Aviation Administration (FAA) letter and data reports are presented. These reports were issued by the National Aviation Facilities Experimental Center (NAFEC) to the System Research and Development Service (SRDS) between the years 1971 to 1975, and cover testing and evaluation efforts for visual guidance and airport lighting configurations. Author

N76-29202# Texas Instruments, Inc., Dallas.
NON-IMAGE GLIDESCOPE INVESTIGATION Final Report, 16 May 1974 - 29 Feb. 1976
Robert C. Voges and Charles Liu Feb. 1976 109 p refs
(Contract DOT-FA74WA-3452)
(AD-A025281/7; TI-DM75-01-13; FAA-RD-76-48) Avail: NTIS HC $5.50 CSCL 17/7

The analysis and design of a broadside glideslope antenna array and its shielded loop elements are presented. This nonimage array is intended to replace the glideslope image array in regions where the latter does not perform well, such as in unlevel terrain or over tidal water. The synthesis of the array is presented with an analysis of its required height. The tower design and the design of a corner reflector behind the loops are given. The major effort was the design of the shielded loop, a single-turn loop of stripline construction. Its impedance is matched with a series stub and a broadbanding circuit integral in the stripline feed. An integral monitor design is also described. The sensitivity of the loop impedance to rain and ice is investigated, as well as the performance of various radome approaches. An integral radome and a conventional type are discussed. Finally, a three-element array with a small distribution network is described and its performance presented. Full-sized distribution and monitor networks are discussed. The feasibility of using the loop element in existing image arrays is demonstrated, and a detailed design of a coaxial construction with a single-rod reflector is given. Author

N76-29203# Mitre Corp., Atlantic City, N.J.
INTERFACE DEFINITION DABS ENGINEERING MODEL/ATC (NAFEC), DIGITAL SIMULATION FACILITY CONFIGURATION, VOLUME 5
Royal A. Westcott Dec. 1975 27 p refs
(Contract DOT-FA69NS-162)
(AD-A025235/3; MTR-4221-Vol-5; FAA-RD-74-159-Vol-5) Avail: NTIS HC $4.00 CSCL 17/7

The hardware interfaces between the Digital Simulation Facility (DSF) and the Air Traffic Control (ATC) facilities at NAFEC are defined. These configurations will be used in tests that require the DSF to simulate the DABS engineering models. The interfaces between the DABS engineering models and the ATC facilities are described. Author

N76-29204# National Aviation Facilities Experimental Center, Atlantic City, N.J.
PLAN VIEW DISPLAY (PVD) BACKGROUND LIGHTING Final Report, Nov. 1974 - Dec. 1975
John Aschenbach, and Richard L. Sulzer May 1976 62 p refs
(AD-A024954; FAA-NA-76-3) Avail: NTIS HC $4.50 CSCL 17/9

Controllers at air route traffic control centers (ARTCC's) have complained that display information on plan view displays (PVD's) causes eyestrain and headaches after a prolonged period of controlling traffic. The controllers indicated that background brightness level similar to the type previously experienced for raster-scanned displays might be a remedy. Therefore, an investigation and evaluation of several methods of generating a uniform background brightness on the PVD were conducted. Results show that the defocused raster method is the most effective and practical type of background brightness generation to be considered for field evaluation. The etched-surface cathode-ray tube also tended to produce a more uniform background illumination than most techniques investigated. Author

N76-29205# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A FLIGHT INVESTIGATION OF SYSTEM ACCURACIES AND OPERATION CAPABILITIES OF AN AIR TRANSPORT AREA NAVIGATION SYSTEM Final Report, Sep. 1974 - Apr. 1975
Robert H. Pursel and Jack D. Edmonds May 1976 100 p
(AD-A025139/7; FAA-NA-75-71; FAA-RD-76-32) Avail: NTIS HC $5.50 CSCL 17/7

Flight tests were conducted at the National Aviation Facilities Experimental Center (NAFEC) using an Aeronautical Radio Incorporated (ARINC) Characteristic 582-4, Mark 2 Air Transport Area Navigation System to investigate area navigation (RNAV) system accuracies and resultant airspace requirements with emphasis being given to the terminal area. The system was operated in various navigational configurations including dual very high frequency omnidirectional radio range/distance measuring equipment (VOR/DME), single VOR/DME, and dual DME. Statistical data are presented for the various error components making up the RNAV total system error. Various operational capabilities were also investigated, and graphical data are presented for parallel offsets, paralleling in turns, and turn anticipation. The most accurate modes were dual DME and dual VOR/DME with single VOR/DME being the least accurate. The feasibility of a flight technical error of less than plus or minus 1.0 nmi in the terminal area was demonstrated. Author

N76-29206# Sierra Research Corp., Buffalo, N.Y.
EVALUATION OF DIGITAL DATA BROADCAST FOR AREA NAVIGATION Interim Report
K. Warner, M. Hughes (Champlain Technology Industries), and R. Elliott (Champlain Technology Industries) Apr. 1976 115 p refs Prepared in cooperation with Champlain Technology Industries
(Contract DOT-FA75WA-3634)
(AD-A024514/2; TR-1349; FAA-RD-76-60) Avail: NTIS HC $5.50 CSCL 17/7

The Digital Data Broadcast (DDB) system was evaluated. The results of the DDB flight test program indicate a positive reduction in cockpit workload and pilot blunder through the utilization of the DDB concept in the RNAV environment system. The DDB concept was satisfactorily proved by the utilization of the DDB engineering model hardware. Specific areas of recommended improvement are modifications to X-mode DDB pulse spacing and to waypoint designators. The operational utilization of the DDB concept permits its user to devote more time to cockpit management duties, since it reduces the required RNAV navigation input times and, thereby, reduces cockpit workload. Author

N76-29207# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DABS SENSOR INTERACTIONS WITH ATC FACILITIES
D. Reiner and H. F. Vandevenne 22 Apr. 1976 53 p refs
(Contract DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A025427/6; ATC-51; FAA-RD-75-92) Avail: NTIS HC $4.50 CSCL 17/7

The interactions that occur between a DABS sensor and an ATC facility (terminal or enroute) are presented in order to make full use of the capabilities provided by the addition of DABS sensors to the ATC system. There are three functions of the interactions: (1) handle surveillance reports from the DABS site, (2) handle the two-way digital communications messages between pilots and controllers, and (3) handle a variety of control data messages between the two sites. For each kind of interaction, the actions taken by the DABS sensor are summarized, the messages involved in the transaction are defined, and suggestions are made concerning possible appropriate actions by the ATC facility. The latter include message generation and display, data processing, and controller and system manager activities. Author

N76-29208# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THREE DIMENSIONAL AREA NAVIGATION: FLIGHT TEST AND ERROR STUDY USING A BASIC VNAV SYSTEM Final Report
Gregory W. Tomsic Jan. 1976 204 p refs
(AD-A025764/2; FAA-RD-76-12) Avail: NTIS HC $7.75 CSCL 17/7

The results are summarized of a three-dimensional area navigation flight test. Horizontal error parameters evaluated included navigation sensor (VOR/DME) error, flight technical error, computer error and total system error. Vertical error parameters evaluated included altimetry error, flight technical error, vertical error due to along track error, computer error, and total system error. Three vertical profiles were flown in a six segment test route: three-degree climbs, three-degree descents, and a six-degree descent. Statistical evaluations were performed on the data, and resulting values were then compared to FAA Advisory Circular 90-45A values. Statistical envelope plots for each segment and error type were generated as aids in evaluating the data. Tabular listings, by flight segment, are provided for each error type, as well as route summaries. Author

N76-29209# Federal Aviation Administration, Washington, D.C.
INTEGRATED NATIONAL AIRSPACE COMMUNICATION SYSTEM (INACS) FOR THE SUPPORT OF AIR TRAFFIC CONTROL OPERATIONS IN THE 1980'S AND 1990'S. PROGRAM PLANNING AND FORMULATION, PHASE 1 PROGRAM PLAN
Oct. 1975 31 p
(AD-A015823; FAA-INACS-061-221-P1) Avail: NTIS CSCL 17/7

The state-of the-art in communications technology offers opportunities for a substantial reduction in total FAA communications recurring costs together with a significant improvement in overall communications operational flexibility, reliability and service. An integrated national system, which provides both voice and data communications for all FAA operational facilities and the attendant ATC support functions, can save an estimated 100 million dollars per year in the FAA annual communications budget. GRA

N76-29210# Federal Aviation Administration, Washington, D.C.
INTEGRATED NATIONAL AIRSPACE COMMUNICATION SYSTEM (INACS) FOR THE SUPPORT OF AIR TRAFFIC CONTROL OPERATIONS IN THE 1980'S AND 1990'S. SYSTEM CONCEPT
Sep. 1975 32 p
(AD-A015824; FAA-INACS-061-221-SC) Avail: NTIS CSCL 17/7

The document introduces the concept of an integrated communications approach to meet total FAA operational communications requirements projected for the 1980s and beyond. As a concept, this integrated approach differs from the historical method of satisfying FAA's communications needs by the acquisition or development of dedicated facilities and networks which are designed to serve specific categories of users and which perform specific and dedicated communications functions for these users. State-of-the art communications technology appropriately applied to an integrated system offers opportunities for a substantial reduction in projected total FAA communications recurring costs together with a significant improvement in overall communications operational capability, flexibility and reliability. GRA

N76-29211# Naval Air Development Center, Warminster, Pa. Dept. of Aero-Electronic Technology.
DIRECTION OF ARRIVAL ANGLE PREDICTION Interim Report, Jul. - Aug. 1975
Robert D. Hayes and Ernest W. Coleman 21 Jan. 1976 95 p (WR0000101)
(AD-A021311; NADC-75223-20) Avail: NTIS CSCL 17/3

An existing computer program which is called the roll plane program was modified. This modification made possible the calculation of the direction of arrival angle from an emitting source. The simulation of a detection scheme which was mounted on an aircraft was a three-element antenna array. Through phase shifting techniques in this array the direction arrival angle was calculated. Author (GRA)

N76-29212# Human Factors Research, Inc., Goleta, Calif.
THE INTEGRATED LAUNCH-AND-RECOVERY TELEVISION SURVEILLANCE SYSTEM (ILARTS): CONSOLE DESIGN Final Technical Report
S. P. Rogers and Gail J. Borden 27 Feb. 1976 92 p refs
(Contract N68335-75-C-1391)
(AD-A022118; TR-1768) Avail: NTIS CSCL 01/2

The report contains design recommendations for the Integrated Launch-and-Recovery Television Surveillance System (ILARTS). It includes: A description of the ILARTS system, its functions and components, and its personnel requirements; detailed design recommendations for displays and controls necessary to operate the camera systems, the servo systems, the video tape recorders, and the switching systems; and a description and functional drawings of the configuration of the ILARTS control console and of the arrangement of the individual components on the console. GRA

N76-29213# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
ANALYSIS OF A REFERENCE SYSTEM FOR A MOBILE LABORATORY Final Report, Jan. 1974 - Mar. 1975
S. H. Musick Jan. 1976 169 p refs
(AF Proj. 6095)
(AD-A021480; AFAL-TR-75-193) Avail: NTIS CSCL 17/7

An inertial reference system has been designed for the Mobile Evaluation Laboratory using a KT-70 Inertial Measurement Unit, a speed sensor, a device for providing position data and two digital computers. The analysis needed to optimally combine the outputs of these equipments in the computer(s) has been accomplished. This analysis produced a twelve state recursive Kalman filter based on an error-state-space problem formulation. The Kalman error estimates are fed back to the INS to correct it. Means for handling the high data rate from the speed sensor have been analyzed and a computationally simple one has been chosen. The entire problem has been formulated in a computer simulation that was used in designing the system and predicting its performance. The final design will provide stable and accurate performance over a wide range of measurement conditions. GRA

N76-29214# Naval Postgraduate School, Monterey, Calif.
A NAVIGATION MICROCOMPUTER AND SHIPBOARD INFORMATION DISTRIBUTION Final Report, Sep. 1974 - Jun. 1975
V. Michael Powers 1 Jan. 1976 13 p refs
(AD-A021829; NPS-72PW76011) Avail: NTIS CSCL 17/7

A program to calculate position from three celestial sightings has been written in BASIC. It is suggested that the program be implemented on a microcomputer configured as a navigation calculator. An extension of the idea of the distribution of the result would be an integrated navigation system. GRA

N76-29215# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
DIGITAL NAVIGATOR ANALYZER PROGRAMMING
Joseph S. Ingegneri 23 Dec. 1975 27 p
(AD-A021336; RG-76-36) Avail: NTIS CSCL 19/3

The Digital Navigator Analyzer in conjunction with the Hewlett Packard 2100 computer will determine the accuracy of the land navigator as it travels over a surveyed course. This technical report presents a discussion on the software portion of this effort. GRA

N76-29216# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
ANALYSIS AND DESIGN OF A TERMINAL HOMING SYSTEM DIGITAL AUTOPILOT
R. E. Yates, J. A. Templeton (Computer Sci. Corp., Huntsville, Ala.), J. T. Bosley (Computer Sci. Corp., Huntsville, Ala.), K. D. Dannenberg (Computer Sci. Corp., Huntsville, Ala.), and S. L. OHanian (Computer Sci. Corp., Huntsville, Ala.) 11 Nov. 1975 112 p refs
(DA Proj. 1W3-62303-A-214)
(AD-A022084; RG-76-48) Avail: NTIS CSCL 17/7

This report documents the design and performance analysis of a digital autopilot for the terminal Homing Accuracy Demonstration (THAD) program. This autopilot utilizes a digital processor for guidance and stabilization of the T6 missile with the Army Laser Seeker. Under the study guidelines, the autopilot configuration is essentially unchanged, using the laser seeker to generate pitch/yaw proportional navigation signals and two-degrees-of-freedom attitude gyros for pitch/yaw/roll stabilization. The digital

autopilot performance is equal to or exceeds that of the existing analog autopilot, the performance criteria being circular error probability (CEP) and the offset of its centroid from the target. Author (GRA)

N76-29292 Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
APPLICATION OF FLIGHT SIMULATION TO DEVELOP, TEST, AND EVALUATE THE F-14A AUTOMATIC CARRIER LANDING SYSTEM
Robert L. Fortenbaugh and James M. Rebel (NATC) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

N76-29298 Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
A JOINT PILOT/LANDING OFFICER SIMULATION PERFORMED TO DETERMINE AIRCRAFT WAVE-OFF PERFORMANCE REQUIREMENTS
Ronald L. Nave *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 10 p refs (For availability see N76-29287 20-09)

N76-29301 Ecole Nationale Superieure de l'Aeronautique et de l'Espace, Toulouse (France).
SIMULATION OF A VISUAL AID SYSTEM USED FOR THE PILOTING OF HELICOPTERS IN FORMATION FLYING
J. H. Llareus, A. J. Fossard, M. Clique (Centre d'Etudes et de Recherches, Toulouse), and N. Imbert (Centre d'Etudes et de Recherches, Toulouse) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 14 p refs In FRENCH (For availability see N76-29287 20-09)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-29217* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBLIQUE-WING SUPERSONIC AIRCRAFT Patent
Robert T. Jones, inventor (to NASA) Issued 27 Jul. 1976 19 p Filed 12 Aug. 1974 Supersedes N74-30414 (12 - 20, p 2369) Continuation of abandoned US Patent Appl. SN-321180, filed 5 Jan. 1973, which is a Continuation-in-part of US Patent Appl. SN-206279, filed 9 Dec. 1971, US-Patent-3,737,121
(NASA-Case-ARC-10470-3; US-Patent-3,971,535; US-Patent-Appl-SN-496779; US-Patent-Class-244-46; US-Patent-Appl-SN-321180; US-Patent-Appl-SN-206279; US-Patent-3,737,121) Avail: US Patent Office CSCL 01C

An aircraft including a single fuselage having a main wing and a horizontal stabilizer airfoil pivotally attached at their centers to the fuselage is described. The pivotal attachments allow the airfoils to be yawed relative to the fuselage for high speed flight, and to be positioned at right angles with respect to the fuselage during takeoff, landing, and low speed flight. The main wing and the horizontal stabilizer are upwardly curved from their center pivotal connections towards their ends to form curvilinear dihedrals. Official Gazette of the U.S. Patent Office

N76-29218*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF ADVANCED TECHNOLOGY TO FUTURE LONG-RANGE AIRCRAFT
Owen E. Schrader 24 May 1976 49 p refs Presented at 35th Ann. Conf. of the Soc. of Allied Weight Engr., Inc., Philadelphia, 24-26 May 1976
(NASA-TM-X-73921) Avail: NTIS HC $4.00 CSCL 01C

An assessment is presented of three separate programs that have incorporated advanced technology into the design of long-range passenger and cargo aircraft. The first technology centers around the use of a span-loaded cargo aircraft with the payload distributed along the wing. The second technology is the application of laminar flow control to the aircraft to reduce the aerodynamic drag. The last program evaluates the production of alternate aircraft fuels from coal and the use of liquid hydrogen as an aircraft fuel. Author

N76-29219 Accession number not used.

N76-29220 Accession number not used.

N76-29221# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF F-15 OPERATIONS AND MAINTENANCE COSTS BASED ON ANALYSIS OF CATEGORY 2 TEST PROGRAM MAINTENANCE DATA M.S. Thesis
Christopher B. Howard Aug. 1975 179 p refs
(AD-A021258; GSM/SM/75S-3) Avail: NTIS CSCL 15/5

The report contains an analysis of the maintenance data collected as part of the F-15 Category II test program from April 1974 through February 1975 with the intent of updating operations and maintenance cost predictions. A brief review of the Systems Effectiveness Data System is included to provide background on the source of the raw maintenance data. This is followed by an analysis of maintenance man-hours per flight hour (MMH/FM) trends based on regression analysis to determine the expected operational maintenance requirements. Failure data are analyzed to determine system and subsystems reliability. Two reliability models are used for this analysis: an exponential model which assumes a constant instantaneous failure rate, and a Weibull model which can represent either an increasing or a decreasing failure rate. GRA

N76-29222# Naval Electronics Lab. Center, San Diego, Calif.
INTERIM PROGRESS SUMMARY AND DESCRIPTION OF A-7 ALOFT SYSTEM Research and Development Report, Mar. 1974 - Dec. 1975
J. R. Ellis 1 Jan. 1976 59 p refs
(WF41X1001; NELC Proj. F228)
(AD-A021257; NELC-TR-1968) Avail: NTIS CSCL 01/3

The A-7 Airborne Light Optical-Fiber Technology (ALOFT) Demonstration was established to confirm that fiber-optic technology is sufficiently practical and mature to be used in internal aircraft data-signal transmissions and to demonstrate the feasibility of a full A-7 system application. Included are explanations of design tradeoffs that led to the components used in the design of the system. A description of the tests conducted by the Naval Electronics Laboratory Center upon the ALOFT components is provided with a summary of the most significant test results. Graphic and written descriptions of the ALOFT system are included. The test phases yet to be completed are summarized. The economic analysis, planned in parallel with the test phase of the project, is briefly described. A classification list of the original signals in the A-7 which have been converted from electrical to fiber-optic transmission is provided. GRA

N76-29223# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PERFORMANCE AND HANDLING QUALITIES EVALUATION: AH-1G HELICOPTER WITH LOW REFLECTIVE INFRARED/OPTICAL PAINT Final Report, 27 Nov. 1974 - 10 Apr. 1975
A. L. Winn, Robert L. Stewart, Edward J. Tavares, and Gary L. Skinner Aug. 1975 53 p refs
(AD-A021407; USAAEFA-75-09) Avail: NTIS CSCL 01/3

The performance and handling qualities of an AH-1G helicopter were evaluated in the basic paint configuration, with the fuselage and main and tail rotors painted with a low reflective infrared (IR)/optical paint (FSN 8010-083-6588), and in a modified IR/optical paint configuration in which the tail rotor blades and the main rotor leading edge were stripped of the IR/optical paint. Flight tests were conducted by the United States Army Aviation Engineering Flight Activity at Edwards Air Force Base, California, between 27 November 1974 and 10 April 1975. Twenty-five flights were flown for a total of 24.7 productive flight hours. Performance testing was limited to hover, level flight, and autorotational descent. Handling qualities were qualitatively evaluated throughout the conduct of the test program. Additionally, maneuvering stability was quantitatively evaluated in the IR/optical paint configuration and compared with results from previous reports. GRA

N76-29224# Bell Helicopter Co., Fort Worth, Tex.
RESULTS OF BENCH TEST ON ELASTOMERIC OIL SEALS FOR THE UH-1 HELICOPTER TRANSMISSIONS Final Report, Nov. 1972 - Jun. 1973
Elias Abraham Dec. 1975 48 p refs
(Contract DAAG46-72-C-0143)
(AD-A022321; AMMRC-CTR-75-13) Avail: NTIS CSCL 11/1

Two elastomeric oil seal designs, one from Chicago Rawhide and the other from National Seal were bench tested in a UH-1 type main transmission at a surface speed of 9470 fpm. Five samples from each design were tested for five hours each, and one sample was tested for 150 hours. Both seal candidate designs performed as well as or better than the baseline production seal tested. Author (GRA)

N76-29225# Systems Control, Inc., Palo Alto, Calif.
IDENTIFICATION OF T-2 AERODYNAMIC DERIVATIVES FROM FLIGHT DATA Final Report
D. A. Buenz, S. Brooks, R. Mohr, and J. Kanow Mar. 1975 112 p refs
(Contract N62269-72-C-0597)
(AD-A021996) Avail: NTIS CSCL 01/3

This report presents the stability and control derivatives of a low speed Navy trainer aircraft, the T-2B, as determined from flight test data. The maximum likelihood method is used for the estimation of the aerodynamic derivatives, instrument biases and random errors, and gust effects. The two flight conditions considered are: (a) low speed, gear down, flaps deflected, sea level, and (b) high speed, gear and flaps up, 10,000 feet altitude. It is shown that it is necessary to include control input bias and in some cases gust effects to get reliable results. Techniques for handling input bias and random noise in input measurement are given. The identified models in each case are verified through several prediction runs. GRA

N76-29226# Aeronautical Research Associates of Princeton, Inc., N.J.
SPECTRAL GUST RESPONSE FOR AN AIRPLANE WITH VERTICAL MOTION AND PITCH Final Technical Report, 1 Nov. 1974 - 30 Sep. 1975
J. C. Houbolt and Guy G. Williamson Wright-Patterson AFB, Ohio AFFDL Nov. 1975 50 p refs
(Contract F33615-75-C-3030)
(AD-A021713; ARAP-256; AFFDL-TR-75-121) Avail: NTIS CSCL 01/1

Gust response analysis based upon power spectral techniques is made for an airplane having the two degree of freedom of vertical motion and pitch. A rather unique formulation of the equations of motion is made, wherein the aerodynamic loads are treated as dependent variables, as are the vertical and pitching motions. Nonsteady lift effects, finite span effects, tail downwash effects, and gust lag effects are all taken into account over the complete frequency range of concern. It is found that the inclusion of pitch considerably alters the response from that found for the case of vertical motion alone. In general, pitch is found to cause a significant attenuation of the response at low frequencies. One of the important findings of the study is the fact that the gust response for the two-degree-of-freedom case can be expressed in a form which is essentially independent of the integral scale of turbulence. Variations in geometric parameters of the airplane, such as tail moment arm, or radius of gyration in pitch, are considered to obtain an idea of the sensitivity of the gust response to these parameters. Author (GRA)

N76-29227# RAND Corp., Santa Monica, Calif.
PARAMETRIC EQUATIONS FOR ESTIMATING AIRCRAFT AIRFRAME COSTS Interim Report
J. P. Large, Harry G. Campbell, and David Cates Feb. 1976 155 p refs
(Contract DAHC15-71-C-0220)
(AD-A022086; R-1693-1-PA/E) Avail: NTIS CSCL 01/3

A set of generalized equations for estimating development and production costs of aircraft airframes on the basis of such characteristics as aircraft weight and speed is presented. (Extensive investigation has shown that these characteristics explain cost variations better than any other objective parameters.) Equations derived by multiple-regression techniques are presented for each of the major cost elements, for total program cost, and for prototype development costs. The report explains the derivation of each equation and describes the treatment of the data, the fitting of regression equations, and selection of preferred equations. A detailed numerical example is included which applies to preferred equations and compares the results to those obtained using several sets of alternative equations. Author (GRA)

N76-29228# United Technologies Corp., Stratford, Conn. Aircraft Div.
CH-54 OPERATIONAL STATISTICS Final Report
Robert W. Caseria Feb. 1976 139 p
(Contract DAAJ02-74-C-0064; DA Proj. 1F2-62203-AH-8603)
(AD-A021692; USAAMRDL-TR-75-51) Avail: NTIS CSCL 01/3

The purpose of the CH-54 Operational Statistics program was to validate the CH-54 helicopter in the Army's tactical aircraft reliability and maintainability model and to analyze the results obtained from the factorially designed arrangement of simulation runs on sensitivity, credibility, and sufficiency. Changes in utilization, failure rate, NORS waiting time, TBO concepts, major inspection durations, and repair/replacement time distributions were studied. Effects on operational availability, intrinsic availability, unscheduled elapsed maintenance downtime (including and excluding NORS time), and mission accomplishment were evaluated. A baseline model was established by making successive simulation interations and refinements until all output statistics tested fell within the allowable statistical range of the expected CH-54B R and M characteristics and operational conditions.
GRA

N76-29258* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STALL/SPIN TEST TECHNIQUES USED BY NASA
Joseph R. Chambers, James S. Bowman, Jr., and Gerald N. Malcolm (NASA Langley) *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p refs (For availability see N76-29245 20-08)
CSCL 01C

N76-29261 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
SPIN INVESTIGATION OF THE HANSA JET
Herbert Neppert *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 7 p refs (For availability see N76-29245 20-08)

N76-29262 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FLIGHT TEST METHODS FOR THE STUDY OF SPINS [METHODES D'ESSAIS DE VRILLES EN VOL]
J. P. Duval *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p In FRENCH (For availability see N76-29245 20-08)

N76-29263 Grumman Aerospace Corp., Calverton, N.Y.
F-14A STALL SPIN PREVENTION SYSTEM FLIGHT TEST
Charles A. Sewell and Raymond D. Whipple *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 7 p refs (For availability see N76-29245 20-08)

N76-29264 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
SPIN FLIGHT TEST OF THE JAGUAR, MIRAGE F1 AND ALPHA-JET AIRCRAFT [ESSAIS DE VRILLES DU JAGUAR, DU MIRAGE F1 ET DE L'ALPHA-JET]
J. Differ, J. P. Duval, and J. Plessy *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 6 p In FRENCH (For availability see N76-29245 20-08)

N76-29265 General Dynamics/Fort Worth, Tex.
YF-16 HIGH ANGLE OF ATTACK TEST EXPERIENCE
John P. Lamers *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 14 p (For availability see N76-29245 20-08)

N76-29266 Naval Air Systems Command, Washington, D.C.
US NAVY FLIGHT TEST EVALUATION AND OPERATIONAL EXPERIENCE AT HIGH ANGLE OF ATTACK
Alexander F. Money and Donald E. House (Naval Air Test Center) *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 10 p refs (For availability see N76-29245 20-08)

N76-29294 Boeing Aerospace Co., Seattle, Wash.
USE OF THE FLIGHT SIMULATOR IN YC-14 DESIGN
Robert E. Spitzer *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 14 p refs (For availability see N76-29287 20-09)

N76-29297 Air Force Flight Test Center, Edwards AFB, Calif.
SIMULATION IN SUPPORT OF FLIGHT TEST
Richard R. Hansen, Christopher J. Nagy, and Paul W. Kirsten *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 28 p (For availability see N76-29287 20-09)

N76-29308* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERACTIVE COMPUTERIZED AIR COMBAT OPPONENT
Walter W. Hankins, III *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 9 p (For availability see N76-29287 20-09)
CSCL 01C

N76-29659 British Aircraft Corp., Warton (England).
INFLIGHT FLUTTER IDENTIFICATION OF THE MRCA
D. K. Potter and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich) *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 25-39 refs (For availability see N76-29656 20-39)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-29229# Instrument Flight Center, Randolph AFB, Tex.
LIGHT-LINE VISUAL LANDING HEAD-UP DISPLAY (HUD) EVALUATION, PHASE 1 Final Report
Manuel H. Tapia and Gabriel P. Intano Jan. 1976 61 p
(AD-A021903; IFC-TR-76-1) Avail: NTIS CSCL 01/4

The Light-Line Head-Up Display (HUD) Evaluation is part of an exploratory program being conducted by the Air Force Flight Dynamics Laboratory, Flight Control Division (AFFDL/FGR), Wright-Patterson AFB OH, to investigate HUD systems/concepts to aid the pilot in maintaining a specified vertical path during visual landings. The HUD was evaluated at Randolph AFB by the USAF Instrument Flight Center, Research and Development Division (USAFIFC/RD), to determine the pilots' acceptance and operational utility of the Light-Line HUD from a pilot factors point of view. The Light-Line HUD shows flight path angle, angle-of-attack derived speed error, and lateral touchdown zone information in an easily interpretable form. The HUD (designed as a visual landing aid) provides the pilot a three-dimensional cue (light-line wand). The wand appears to be suspended in space emanating from the pilot's chest, and terminating on the desired aim point. The light-line display system which is focused at infinity, depicts a combination velocity vector (four strobing-line segments) and flightpath vector (transverse bar). Thus, the pilot is provided augmentative information without having to focus on the display. The wand has the capability to move laterally across the focal plane as well as longitudinally. This provides a realistic representation of the flightpath vector in three-dimensional space. GRA

N76-29230# McDonnell Aircraft Co., St. Louis, Mo.
RELIABILITY ANALYSIS OF MICROCIRCUIT FAILURES IN AVIONIC SYSTEMS (RAMFAS) Final Report, 19 Jun. 1974 - 19 Jun. 1975
D. L. Dohm, R. J. McCammack, and T. E. Utz Jan. 1976 108 p
(Contract F30602-74-C-0319; AF Proj. 5519)
(AD-A021428; RADC-TR-76-3) Avail: NTIS CSCL 09/5

The report describes the 12-month study of the Reliability Analysis of Microcircuit Failures in Avionic Systems (RAMFAS) program conducted on F-15 Avionic equipments during the period from June 1974 to June 1975. The objectives of this RAMFAS Program were: (1) To assess the reliability of current microcircuit technology in the avionics environment; (2) To assess the validity and effectiveness of presently used techniques for microcircuit procurement, screening quality assurance and reliability prediction. These objectives were to be achieved through in-depth microcircuit failure analysis and fallout data on the F-15 Head-Up Display (HUD) and Interference Blanker Set (IBS) equipments over the total procurement cycle during the study period. The report documents the analysis of 308 devices out of 438 microcircuit removals from 31,393 microcircuits assembled, tested and shipped to the field in 39 HUD and 35 IBS F-15 equipments. GRA

N76-29289 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Human Engineering Dept.
A METHOD FOR THE GUIDANCE AND CONTROL SYSTEM EVALUATION FROM THE OPERATIONAL POINT OF VIEW
H. Denkscherz and P. Hahn *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 7 p (For availability see N76-29287 20-09)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-29231*# Hamilton Standard, Windsor Locks, Conn.
HAMILTON STANDARD Q-FAN DEMONSTRATOR DYNAMIC PITCH CHANGE TEST PROGRAM, VOLUME 1 Final Report
W. J. Demers, D. J. Nelson, and H. S. Wainauski Jul. 1975 200 p refs 2 Vol.
(Contract NAS3-18513)
(NASA-CR-134861; HSER-6700-Vol-1) Avail: NTIS HC $7.50 CSCL 21E

Tests of a full scale variable pitch fan engine to obtain data on the structural characteristics, response times, and fan/core engine compatibility during transient changes in blade angle, fan rpm, and engine power is reported. Steady state reverse thrust tests with a take off nozzle configuration were also conducted. The 1.4 meter diameter, 13 bladed controllable pitch fan was driven by a T55 L 11A engine with power and blade angle coordinated by a digital computer. The tests demonstrated

an ability to change from full forward thrust to reverse thrust in less than one (1) second. Reverse thrust was effected through feather and through flat pitch; structural characteristics and engine/fan compatibility were within satisfactory limits. Author

N76-29232*# Hamilton Standard, Windsor Locks, Conn.
HAMILTON STANDARD Q-FAN DEMONSTRATOR DYNAMIC PITCH CHANGE TEST PROGRAM, VOLUME 2 Final Report
W. J. Demers, D. J. Nelson, and H. S. Wainauski Jul. 1975 439 p 2 Vol.
(Contract NAS3-18513)
(NASA-CR-134862; HSER-6700-Vol-2) Avail: NTIS HC $11.75 CSCL 21E
For abstract, see vol. 1.

N76-29233*# Pratt and Whitney Aircraft, East Hartford, Conn.
STUDY OF UNCONVENTIONAL AIRCRAFT ENGINES DESIGNED FOR LOW ENERGY CONSUMPTION Final Report
D. E. Gray Jun. 1976 142 p refs
(Contract NAS3-19465)
(NASA-CR-135065; PWA-5434) Avail: NTIS HC $6.00 CSCL 21A

Declining U.S. oil reserves and escalating energy costs underline the need for reducing fuel consumption in aircraft engines. The most promising unconventional aircraft engines based on their potential for fuel savings and improved economics are identified. The engines installed in both a long-range and medium-range aircraft were evaluated. Projected technology advances are identified and evaluated for their state-of-readiness for application to a commercial transport. Programs are recommended for developing the necessary technology. Author

N76-29234*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
SINGLE STAGE, LOW NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 5: FAN ACOUSTICS. SECTION 1: RESULTS AND ANALYSIS
R. R. Jutras May 1976 232 p refs
(Contract NAS3-16813)
(NASA-CR-134894) Avail: NTIS HC $8.00 CSCL 21E

The acoustic tests and data analysis for a 0.508-scale fan vehicle of a 111,300 newton (25,000 pound) thrust, full-size engine, which would have application on an advanced transport aircraft, is described. The single-stage advanced technology fan was designed to a pressure ratio of 1.8 at a tip speed of 503 m/sec (1,650 ft/sec) to achieve the desired pressure ratio in a single-stage fan with low radius ratio (0.38), and to maintain adequate stall margin. The fan has 44 tip-shrouded rotor blades and 90 outlet guide vanes. The two basic approaches taken in the acoustic design were: (1) minimization of noise at the source, and (2) suppression of the generated noise in the inlet and bypass exhaust duct. Suppression of the generated noise was accomplished in the inlet through use of the hybrid concept (wall acoustic treatment plus airflow acceleration suppression) and in the exhaust duct with extensive acoustic treatment including a splitter. The goal of the design was attainment of twenty effective perceived noise decibels (20 EPNdB) below current Federal Air Regulation noise standards for a full-scale fan at the takeoff, cutback, and approach conditions. The suppression goal of FAR 36-20 was not reached, but improvements in the technology of both front and aft fan-noise suppression were realized. The suppressed fan noise was shown to be consistent with the proposed federal regulation on aircraft noise. Author

N76-29235# Tennessee Univ., Tullahoma. Space Institute.
INVESTIGATION OF FEASIBLE NOZZLE CONFIGURATIONS FOR NOISE REDUCTION IN TURBOFAN AND TURBOJET AIRCRAFT. VOLUME 1: SUMMARY AND SELECTED MULTINOZZLE CONFIGURATIONS Final Report, Jun. 1972 - Jul. 1975
B. H. Goethert, J. R. Maus, W. A. Dunnill, and Ingo U. Borchers Jul. 1975 337 p refs
(Contract DOT-FA72WA-3053)
(AD-A024958/1; FAA-RD-75-162-Vol-1) Avail: NTIS HC $10.00 CSCL 21/5

Techniques for reducing the noise generated by high velocity jet streams exhausting from a wide variety of nozzle configurations were developed. In addition to exploring the techniques for noise suppression and/or redirection, emphasis was placed on investigating the physical mechanisms at work in the generation, suppression, and redirection of aerodynamic noise. Author

N76-29236# Tennessee Univ., Tullahoma. Space Institute.
INVESTIGATION OF FEASIBLE NOZZLE CONFIGURATIONS FOR NOISE REDUCTION IN TURBOFAN AND TURBOJET AIRCRAFT. VOLUME 2: SLOT NOZZLE CONFIGURATIONS Final Report, Jun. 1972 - Jul. 1975
B. H. Goethert, J. R. Maus, W. A. Dunnill, Grant T. Patterson, Mahendra C. Joshi, Ken C. Shih, Daryl W. Sinclair, Ingo U. Borchers, and Philip M. Yee Jul. 1975 339 p refs
(Contract DOT-FA72WA-3053)
(AD-A024959/9; FAA-RD-75-162-Vol-2) Avail: NTIS HC $10.00 CSCL 21/5
For abstract, see Vol. 1.

N76-29237# Purdue Univ., Lafayette, Ind. School of Aeronautics, Astronautics and Engineering.
PHASE 2 OF FEASIBILITY STUDY OF INITIAL AIRCRAFT PROPULSION SUBSYSTEM INTEGRATION COST MODEL, PART 2 Final Report, 26 Feb. - 1 Oct. 1975
John W. Drake, Mostafa R. Reda, and James J. Allen, Jr. Oct. 1975 126 p refs
(Contract F33615-74-C-2014; AF Proj. 3145)
(AD-A021083; Rept-75-2-Pt-2; AFAPL-TR-75-88-Pt-2) Avail: NTIS CSCL 21/5

This report describes two methods of estimating the production costs of jet engines not yet built: (1) by building up the costs of the 'cost driving' parts in a traditional Industrial Engineering fashion; and (2) by using regression techniques to estimate either entire engine costs (RAND approach) or parts of engines. The report concludes that both methods are feasible though the former has a greater theoretical accuracy. Potential problems of accounting for changes in performance and schedule may well give the second method the edge in practical application on the bases of cost, speed and speed of implementation.
Author (GRA)

N76-29238# Purdue Univ., Lafayette, Ind. School of Aeronautics, Astronautics and Engineering Sciences.
FEASIBILITY STUDY OF INITIAL AIRCRAFT PROPULSION SUBSYSTEM INTEGRATION COST MODEL, PHASE 1, PART 1 Final Report, 9 Sep. - 31 Dec. 1974
John W. Drake, Mostafa R. Reda, and James J. Allen, Jr. Oct. 1975 65 p ref
(Contract F33615-74-C-2014; AF Proj. 3145)
(AD-A021075; AA/ES-74-1-Pt-1; AFAPL-TR-75-88-Pt-1) Avail: NTIS CSCL 21/5

This report describes two methods of estimating the production costs of jet engines not yet built: (1) by building up the costs of the 'cost driving' parts in a traditional Industrial Engineering Fashion and (2) by using regression techniques to estimate either entire engine costs (RAND approach) or parts of engines. The report concludes that both methods are feasible though the former has a greater theoretical accuracy. Potential problems of accounting for changes in performance and schedule may well give the second method the edge in practical application on the bases of cost, speed and speed of implementation. GRA

N76-29239# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
REPRESENTATIVE ENGINE POWER DATA FOR ARMY HELICOPTERS Final Report, 1 Jul. - 1 Sep. 1975
Terry L. Cox Feb. 1976 37 p refs
(Contract DAAJ01-75-C-1051)
(AD-A022254; TI-073820-75-1; DRSAV-76-5) Avail: NTIS CSCL 21/5

With rapid engine torque pressure changes as the factor of prime interest, some 700 hours of multichannel oscillogram data recorded on AH-1G and UH-1H helicopters while they operated in Southeast Asia and Alaska were reviewed with 5.4 hours selected and processed to obtain engine power data suitable for the development of criteria for future low-cycle fatigue testing of advanced helicopter engines. After short and medium flight lengths were determined, a representative flight was selected

for each of seven categories of aircraft type, geographical location, mission type (utility, combat assault, and combat support), and flight length. Four parameters in the seven flights were processed: engine torque pressure, main rotor speed, outside air temperature (OAT), and pressure altitude. The intermediate rated power (IRP) limit was computed as a function of OAT and altitude and the engine shaft horsepower was derived from the rotor speed and torque pressure to yield the percent IRP. Data presentations include histograms of the flight length frequency distributions; time histories of the percent IRP, altitude, and OAT; histograms of the percentage of time in percent IRP ranges; and a tabular summary of the 13 torque excursions in the seven flights and related data. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-29240*# Kanner (Leo) Associates, Redwood City, Calif.
EVOLUTION OF SPIN CHARACTERISTICS WITH AIRCRAFT STRUCTURE
J. Gobeltz (Lille Inst. of Fluid Mechanics, France) Washington NASA Aug. 1976 40 p Transl. into ENGLISH of paper presented at SMP Specialists Meeting, Brussels, 18-21 Nov. 1976 p 14-15
(Contract NASw-2790)
(NASA-TT-F-17123) Avail: NTIS HC $4.00 CSCL 01C

Differences in the spin characteristics of the main historical types of aircraft have resulted from structural differences such as increased stabilizer size, greater sweep-back, and fuselage stretch. Specific variables affecting the type of spin of an aircraft are analyzed with reference to a group of 117 military and nonmilitary aircraft of post-1940 design. These variables include the effects of the yaw, pitch and roll attitude control surfaces, flaps, slats, hatches, overall shapes, horizontal and vertical stabilizers, inertial characteristics, and outer loads. The modifications of spin occurring in different versions of the same aircraft are discussed in regard to the Mirage III Delta. Author

N76-29241*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF KRUEGER NOSE FLAPS ON THE EXPERIMENTAL FORCE AND MOMENT CHARACTERISTICS OF AN OBLIQUE WING
Edward J. Hopkins and George H. Lovette Washington Jul. 1976 208 p refs
(NASA-TM-X-3372; A-6362) Avail: NTIS HC $7.75 CSCL 01A

Experimental force and moment data are presented for an oblique wing mounted on a body of revolution and equipped with Krueger type nose flaps. The effectiveness of these flaps in making the moment curves more linear by controlling the flow separation on the downstream wing panel at high lift coefficients was determined. The investigation of the effects of the Krueger flaps covered two cases: (1) use of the flaps on the downstream wing panel only and (2) use of the flaps on both wing panels. For part of the tests, the Krueger flaps were mounted on nose flaps that were drooped either 5 deg or 10 deg. The wing was elliptical in planform, had an aspect ratio of 6.0 (based on the unswept span) and was tested at sweep angles of 0, 45 deg, and 50 deg. The Mach-number range covered was from 0.25 to 0.95. It was found that the most effective arrangement of the Krueger flaps for making the pitching-, rolling-, and yawing-moment curves more linear at high lift coefficients was having the Krueger flaps mounted on the nose flaps drooped 5 deg and only on the downstream wing panel. Author

N76-29242# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
TERRAIN FOLLOWING CONTROL BASED ON AN OPTIMIZED SPLINE MODEL OF AIRCRAFT MOTION Ph.D. Thesis
J. E. Funk Nov. 1975 192 p refs
(AD-A021328; ASD/XR-TR-75-22) Avail: NTIS CSCL 01/2

The major portion of the computational processing of information in an aircraft terrain following system is optimized in order to provide the best commands to the longitudinal flight-control system based on available terrain data. Previous terrain-following processors have not optimized the flight path subject to all of the practical constraints. The scheme presented incorporates all of the major constraints into an optimization problem that can be solved to provide a reference path for the aircraft to follow. The optimal reference path satisfied two important requirements: (1) it stays as close to the terrain as possible while satisfying a minimum clearance constraint and the specified acceleration limits, and (2) it is a smooth path that the aircraft can follow extremely well by a very simple tracking system. The optimization problem is either a quadratic or linear programming problem, depending upon the specific closeness performance criterion chosen. It appears that it can be solved in real time, even for a very high speed missile, by an airborne digital computer when accurate vehicle state and terrain information are available. The optimal solutions to the problem can also be used as 'ideal' paths to provide standards for evaluating other types of terrain following systems.
Author (GRA)

N76-29243# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
INVESTIGATIONS RELATED TO THE USE OF ATMOSPHERIC ELECTRIC FIELDS FOR AIRCRAFT AND RPV STABILIZATION
M. L. Hill and T. R. Whyte Jun. 1975 253 p refs
(Contract N00017-72-C-4401)
(AD-A022051; APL-JHU-TG-1280) Avail: NTIS CSCL 01/2

The atmospheric electric field is oriented vertically, or very nearly so, over a large fraction of the earth a large fraction of the time. Low-cost, lightweight, rugged electronic devices have been used to sense the electric field and provide a vertical reference for airborne vehicles. This report describes some research that has been done to attempt to clarify the performance and practicability of this concept. A review of atmospheric electricity is given along with a description of original theoretical and experimental work dealing with the electrostatic sensing system. Data obtained during flight tests with an instrumented Cessna Skymaster aircraft are reported. The results support the expectation that there are some limitations associated with weather, but it appears that the concept may be useful under a sufficiently wide variety of atmospheric conditions so that improved or new capability in military systems might be achieved by applying this technology to special classes of vehicles. GRA

N76-29244# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A DESIGN OF A MODAL CONTROLLER FOR THE B-52 CONTROL CONFIGURED VEHICLE (CCV) M.S. Thesis
Ronald M. Adams Dec. 1975 176 p refs
(AD-A021872; GE/EE/75D-9) Avail: NTIS CSCL 01/3

A large-order multi-input multi-output state-variable model and design specification was recently developed for the B-52 Control Configured Vehicle (CCV) longitudinal axis. This model gives the opportunity to use modern control techniques to design the CCV concepts of interest. Previously the B-52 CCV control task was designed in increments using conventional control techniques. When the entire control problem is formulated and drawn up in one specification however, the designer's job becomes significantly more difficult. Modern control techniques are available which permit the large multi-input multi-output control problem to be addressed. For this thesis, modal control theory is applied to the B-52 CCV state-variable model. The pertinent theory is presented and then a multi-stage design procedure is applied. GRA

N76-29245# Advisory Group for Aerospace Research and Development, Paris (France).
STALL/SPIN PROBLEMS OF MILITARY AIRCRAFT
Jun. 1976 242 p refs Presented at the Flight Mech. Panel Specialists Meeting, Rhode Saint Genese, Belgium, 18-21 Nov. 1975
(AGARD-CP-199) Copyright. Avail: NTIS HC $8.00

Stall/spin aspects of aircraft design are discussed in relation

to the high angle of attack problem. For individual titles, see N76-29246 through N76-29266.

N76-29246 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE STALL/SPIN PROBLEM
Robert J. Woodcock and Robert Weissman (ASD) *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p refs (For availability see N76-29245 20-08)

Stall/spin problems still plague aircraft designers. The development of spin tunnel and free flight model testing techniques is traced, prospects of improved aerodynamics are indicated, and some flight control system capabilities outlined, with reference to experience with some recent airplanes. Recovery from spins and post-stall gyrations is emphasized but a need for more emphasis on designing for resistance to loss of control is advocated. Author

N76-29247 General Dynamics/Fort Worth, Tex.
THE STALL/SPIN PROBLEM - AMERICAN INDUSTRY'S APPROACH
Charles A. Anderson *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 8 p (For availability see N76-29245 20-08)

An attempt is made to detail what has caused stall/spin problems, what options are open to the aircraft designer to reduce stall/spin susceptibility, and some of the current evaluation criteria that are available. Also, the various analytical and experimental tools and flight test techniques available today are reviewed. An assessment is then made of the usefulness of each of these guidelines, tools, and techniques. Finally, a recommended procedure for determining the stall/spin susceptibility and characteristics is presented. Author

N76-29248 Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
COMPARISON OF THE SPIN AND LOW INCIDENCE AUTOROTATION OF THE JAGUAR STRIKE AIRCRAFT
R. J. Blamey *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 10 p refs (For availability see N76-29245 20-08)

From the extensive flight trials on Jaguar high incidence and spin behavior, a number of interesting results emerged. Compared is the classical high incidence spin mode with a rather less common low incidence autorotation which appeared during Jaguar evaluation trials. Author

N76-29249 British Aircraft Corp., Preston (England).
A COMPARISON OF MODEL AND FULL SCALE SPINNING CHARACTERISTICS ON THE LIGHTNING
B. R. A. Burns *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p (For availability see N76-29245 20-08)

Lightning spinning history is reviewed and a comparison is made of the characteristics as shown by vertical wind tunnel, helicopter drop model and full scale flight trials. The comparison is made in terms of both qualitative interpretation of the spin and recovery behavior and measured data. It is shown that the three types of tests exhibited good qualitative agreement in all important respects. Only a limited quantitative comparison is possible because of limitations of the measured data and differences between the test techniques. The test results are related to service experience and some observations are made about the interpretation of spinning test results and the need for simplicity in pilot's operating notes. Author

N76-29250 Northrop Corp., Hawthorne, Calif.
DESIGN TECHNOLOGY FOR DEPARTURE RESISTANCE OF FIGHTER AIRCRAFT Aircraft Div.
A. Titiriga, Jr., J. S. Ackerman, and A. M. Skow *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 13 p refs (For availability see N76-29245 20-08)

Methods are presented for predicting departure characteristics of aircraft during the design stages prior to model or flight tests. The significance of longitudinal pitching moment characteristics with respect to sideslip is discussed and correlated with flight test data. The use of departure parameters is discussed and examples are presented which show good correlation with flight test results. A computer graphics display of the aircraft driven by actual flight test data has proven to be extremely helpful in visualizing complex motions of an aircraft. In particular this technique shows great promise in aiding both pilots and engineers in describing disorienting post stall gyrations that may be encountered during stall/spin flight testing of an aircraft. Author

N76-29251* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS OF RECENT NASA STUDIES ON SPIN RESISTANCE
Joseph R. Chambers, William P. Gilbert, and Sue B. Grafton *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p refs (For availability see N76-29245 20-08)
CSCL 01C

Some of the factors which contribute to good stall/spin characteristics of a current fighter configuration indicate that the design of airframe components for inherent spin resistance is very configuration dependent and that few generalizations can be made. Secondary design features, such as fuselage forebody shape, can have significant effects on stability characteristics at high angles of attack. Recent piloted simulator studies and airplane flight tests have indicated that current automatic control systems can be tailored so as to provide a high degree of spin resistance for some configurations without restrictions to maneuverability. Such systems result in greatly increased pilot confidence and increased tactical effectiveness. Author

N76-29252 Institut de Mecanique des Fluides de Lille (France).
APPLICATION OF STATIC AND DYNAMIC AERODYNAMIC COEFFICIENTS TO THE MATHEMATICAL CORRELATION OF WIND TUNNEL TEST RESULTS ON AIRCRAFT SPINS [APPLICATION DES MESURES DE COEFFICIENTS AERODYNAMIQUES STATIQUES ET DYNAMIQUE A DES RECOUPEMENTS PAR CALCUL DES VRILLES OBTENUES EN SOUFFLERIE]
Marc Vanmansart *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p In FRENCH (For availability see N76-29245 20-08)

A conventional light aircraft model with efficient control surfaces and comparatively easy spin characteristics was used to validate the modelling of spin maneuvers by correlating vertical wind tunnel results with static and dynamic aerodynamic coefficients. It was first concluded that these coefficients must be measured while the aircraft is in continuous rotation; these measurements must take into account the efficiency of the control surfaces, which is itself strongly affected by the general flow pattern, and are only applicable to the case of comparatively mild spins. In the case of modern military aircraft, however, spins are usually more complex and violent, and measurements of forced oscillations while the model is in continuous rotation should presumably be included. Transl. by Y.J.A.

N76-29253 Aeronautica Macchi S. p. A., Varese (Italy).
STALL BEHAVIOR AND SPIN ESTIMATION METHOD BY USE OF ROTATING BALANCE MEASUREMENTS
Ermanno Bazzocchi *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 16 p (For availability see N76-29245 20-08)

Experimental work is reported in the field of wind tunnel investigation of stall behavior, in the evaluation of the characteristics of lateral control devices, in the measurement of the aerodynamic coefficients to determine lateral-directional stability and the analytical study of the spin. This research has required the development of special test equipment, measurement methods and calibration systems. A description and data is given on the test equipment adopted, its use and some of the results obtained. Author

N76-29254 Ghent Univ. (Belgium).
STABILITY OF HELICOIDAL MOTIONS AT HIGH INCIDENCES
F. C. Haus *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 20 p (For availability see N76-29245 20-08)

Mathematical solutions are found for three kinds of problems: (1) to compute the equilibrium condition of steady motion, when the aircraft follows a helicoidal descending path around a vertical axis; (2) to establish the linear equations governing perturbations about the steady state, and to determine the characteristic modes of the resulting motion; and (3) to integrate the nonlinear equations of motion and to determine the manner in which an aircraft can reach a steady state motion, or depart from it - (entry into

or recovery from a spin). Such mathematical operations provide insight into the mechanics of spinning motion even though aerodynamic coefficients are not known very accurately at the present time. Author

N76-29255 Institut de Mecanique des Fluides de Lille (France).
EFFECTS OF AIRFRAME DESIGN ON SPIN CHARACTERISTICS [EVOLUTION DES CARACTERISTIQUES DE LA VRILLE EN FONCTION DE L'ARCHITECTURE DES AVIONS]
Jean Gobeltz *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 15 p In FRENCH (For availability see N76-29245 20-08)

The effects of changes in the airframe geometry during the last few decades on aircraft spin characteristics were reviewed. The type of aircraft considered ranged from low speed, pre-world war II, propeller driven aircraft, through the early jet aircraft with moderate sweepback, to the most recent jet aircraft with pronounced sweepback. The contribution of the various airframe components such as control surfaces, flaps, airbrakes, fins, fuselage, wings, etc. was discussed in addition to other relevant factors such as inertial characteristics, external loads, rockets, etc. Special emphasis was placed on the Mirage 3 and Lightning aircraft. Y.J.A.

N76-29256 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
LIMITING FLIGHT CONTROL SYSTEMS
David K. Bowser *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p refs (For availability see N76-29245 20-08)

The development and application of various types of automatic flight control systems for high angle of attack augmentation and limiting are reported. Considerations included are improved handling qualities for maximum tracking effectiveness, reduced pilot workload, control configured vehicles, stall inhibitors, and departure prevention systems. Author

N76-29257* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASYMMETRIC AERODYNAMIC FORCES ON AIRCRAFT AT HIGH ANGLES OF ATTACK - SOME DESIGN GUIDES **c02**
Gary T. Chapman, Earl R. Keener, and Gerald N. Malcolm *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p refs (For availability see N76-29245 20-08)
CSCL 01A

Aerodynamic side forces on forebodies are considered that are produced by two types of flow: asymmetric vortices on bodies of revolution and nonuniform flow separation on square bodies with rounded corners under spinning conditions. Steady side forces that can be as large as the normal force are produced by asymmetric vortices on pointed forebodies. This side force has a large variation with Reynolds number, decreases rapidly with Mach number, and can be nearly eliminated with small nose bluntness or strakes. The angle of attack where the side force first occurs depends primarily on body geometry. The theoretical techniques to predict these side forces are necessarily semi-empirical because the basic phenomenon is not well understood. The side forces produced by nonuniform flow separation under spinning conditions depend extensively on spin rate, angle of attack, and Reynolds number. The application of simple crossflow theory to predict this side force is inadequate much below angles of attack of 90 deg. Author

N76-29258* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STALL/SPIN TEST TECHNIQUES USED BY NASA **c05**
Joseph R. Chambers, James S. Bowman, Jr., and Gerald N. Malcolm (NASA Langley) *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 12 p refs (For availability see N76-29245 20-08)
CSCL 01C

Unique test techniques and facilities are reported which are used to predict the stall/spin characteristics of highly maneuverable military aircraft. Three of the more important test techniques are: (1) flight tests of dynamically scaled models; (2) rotary balance tests; and (3) piloted simulator studies. Recent experience has indicated that the extension of piloted simulation techniques to high angles of attack provides valuable insight as to the spin susceptibility of fighter configurations during representative air combat maneuvers. In addition, use of the technique is an effective method for the development and evaluation of automatic spin prevention concepts. Author

N76-29259 Institut de Mecanique des Fluides de Lille (France).
EFFECTS OF STATIC MOMENTS FROM ROCKETS OR ASYMMETRIC LOADS ON AIRCRAFT SPINS [ACTION SUR LA VRILLE, PAR MOMENT STATIQUE, DE FUSEES ET DE CHARGEMENTS DISSYMETRIQUES]
Jean Gobeltz and Lucien Beaurain *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 11 p refs In FRENCH (For availability see N76-29245 20-08)

Vertical wind tunnel test results performed on different scale models to investigate aircraft spin maneuvers were discussed. Two areas were considered: (1) the use of rockets carried on aircraft, to be fired as an emergency device during spins. The application of this concept has so far been limited to light aircraft, although certain qualitative conclusions may be valid for other types of aircraft, including military aircraft; (2) the influence of asymmetrical loads on spins for aircraft of all types: military, light, transport. In the case of military aircraft, geometrical asymmetries were also discussed. Transl. by Y.J.A.

N76-29260 Centre d'Essais en Vol, Bretigny-sur-Orge (France).
A NEW ANALYSIS OF SPIN, BASED ON FRENCH EXPERIENCE ON COMBAT AIRCRAFT [UNE NOUVELLE ANALYSE DE LA VRILLE BASEE SUR L'EXPERIENCE FRANCAISE SUR LES AVIONS DE COMBAT]
Claudius LaBurthe *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p In FRENCH; ENGLISH summary (For availability see N76-29245 20-08)

Relatively few aircraft are lost owing to sinking, stalling or spinning. Among other reasons, this favorable result may be attributed to a particular emphasis put on pilot instruction about aircraft behavior at high angles of attack. But in view of the unfavorable influence of wing loading this situation might deteriorate with new aircraft. Some test results are analyzed as regards the nature of losses of control. The major influence of inertia is thus demonstrated. Limits of credibility for stall warning systems, based upon angle of attack measurement, are then deduced. Author

N76-29261 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
SPIN INVESTIGATION OF THE HANSA JET **c05**
Herbert Neppert *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 7 p refs (For availability see N76-29245 20-08)

Spin characteristics of the Hansa jet from calculation, vertical spin tunnel and flight have been compared. As a result of the superstall a special form of flat spin with low rate of rotation is obtained. An analysis is carried out and various recovery methods are given. Author

N76-29262 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FLIGHT TEST METHODS FOR THE STUDY OF SPINS [METHODES D'ESSAIS DE VRILLES EN VOL] **c05**
J. P. Duval *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 9 p In FRENCH (For availability see N76-29245 20-08)

A system of instruments and techniques developed to investigate aircraft spin maneuvers was described. Both ground-based systems (telemetry, real-time and delayed-time measurements) and airborne systems (instrument management, cameras, etc.) are described and discussed. The Alpha-Jet aircraft is used as an example to illustrate the technique used, including the importance of preliminary wind tunnel test results and the subsequent logical sequence of flight tests. Recent flight test results were illustrated. Transl. by Y.J.A.

N76-29263 Grumman Aerospace Corp., Calverton, N.Y.
F-14A STALL SPIN PREVENTION SYSTEM FLIGHT TEST **c05**
Charles A. Sewell and Raymond D. Whipple *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 7 p refs (For availability see N76-29245 20-08)

The evaluation of various spin prevention design concepts

for the F-14 Tomcat by analytical, simulational, and experimental methods is described. Preparation of the test vehicle is detailed showing unique emergency systems and qualification testing of these systems. Operational aspects of the flight test program including the problem devising a system flexible enough to permit in-flight optimization of design parameters is treated. The gradual shift in emphasis from spin prevention, which was accomplished with relative ease, to departure amelioration for enhanced air combat effectiveness is documented. An overview of the final ARI with associated subsystems is given. Author

N76-29264 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
SPIN FLIGHT TEST OF THE JAGUAR, MIRAGE F1 AND ALPHA-JET AIRCRAFT [ESSAIS DE VRILLES DU JAGUAR, DU MIRAGE F1 ET DE L'ALPHA-JET] **c05**
J. Differ, J. P. Duval, and J. Plessy *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 6 p In FRENCH (For availability see N76-29245 20-08)

A series of flight tests designed to investigate spin characteristics on the following aircraft were described: Jaguar, Mirage F1, and Alpha-Jet. The case of the Alpha-Jet is especially interesting in view of its training role. Results obtained during these tests were described and compared to wind tunnel tests predictions. Transl. by Y.J.A.

N76-29265 General Dynamics/Fort Worth, Tex.
YF-16 HIGH ANGLE OF ATTACK TEST EXPERIENCE **c05**
John P. Lamers *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 14 p (For availability see N76-29245 20-08)

The objective of high angle of attack flight tests was to clear the aircraft for the air combat maneuvering test phase. This was to be accomplished by validation of predicted aerodynamic data, and a comprehensive evaluation of handling qualities and flight control system performance during aggressive simulated tactical maneuvering. The program also included a realistic evaluation of the effectiveness of special automatic control system features designed to enhance high angle of attack maneuverability, handling qualities, and departure resistance. Of particular interest were the effects of the active control system (command and stability augmentation) and relaxed static stability concepts upon stall/spin characteristics and recovery capability. Engine operating characteristics at high angle of attack, high angle of sideslip, low airspeed conditions were also of interest. Results show excellent high angle of attack flight characteristics, good correlation with NASA spin model results, and normal flight control system operation over the range of conditions tested. Author

N76-29266 Naval Air Systems Command, Washington, D.C.
US NAVY FLIGHT TEST EVALUATION AND OPERATIONAL EXPERIENCE AT HIGH ANGLE OF ATTACK **c05**
Alexander F. Money and Donald E. House (Naval Air Test Center) *In* AGARD Stall/Spin Probl. of Mil. Aircraft Jun. 1976 10 p refs (For availability see N76-29245 20-08)

An overview is presented of the problem areas presently considered most significant in the high angle of attack flight regime in U.S. Navy aircraft. The U.S. Navy philosophy of high angle of attack flight testing is also discussed, with examples of some of the more recent programs. Author

N76-29288 British Aircraft Corp., Warton (England). Military Aircraft Div.
THE GROWING CONTRIBUTION OF FLIGHT SIMULATION TO AIRCRAFT STABILITY, CONTROL AND GUIDANCE PROBLEMS
A. G. Barnes *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

N76-29290 Centre d'Essais en Vol, Istres (France).
INVESTIGATION OF THE LANDING APPROACHES FOR A STOL AIRCRAFT USING A FLIGHT SIMULATOR [ETUDE AU SIMULATEUR DU PILOTAGE D'UN AVION STOL EN APPROCHE]
J. P. Petit and J. C. Raynal (ONERA, Modane) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 15 p In FRENCH; ENGLISH summary (For availability see N76-29287 20-09)

N76-29291 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
THE USE OF A FLIGHT SIMULATOR IN THE SYNTHESIS AND EVALUATION OF NEW COMMAND CONTROL CONCEPTS
R. Onken, V. Adam, and R. Dierke *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 16 p refs (For availability see N76-29287 20-09)

N76-29293 Societe Nationale Industrielle Aerospatiale, Toulouse (France). Dept. des Etudes de Qualites de Vol et de Pilotage.
SIMULATION TECHNIQUES AND METHODS USED FOR THE STUDY AND ADJUSTMENT OF THE AUTOMATIC LANDING SYSTEM ON THE CONCORDE SUPERSONIC TRANSPORT AIRCRAFT [MOYENS ET METHODES DE SIMULATION UTILISES POUR L'ETUDE ET LA MISE AU POINT DE L'ATTERRISSAGE AUTOMATIQUE DE L'AVION DE TRANSPORT SUPERSONIQUE CONCORDE]
Raymond Deque and Jean-Louis Bonafe *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 11 p In FRENCH (For availability see N76-29287 20-09)

N76-29295* Kansas Univ., Lawrence.
SIMULATION AND SIMULATOR DEVELOPMENT OF A SEPARATE SURFACE ATTITUDE COMMAND CONTROL SYSTEM FOR LIGHT AIRCRAFT
Jan Roskam *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 15 p refs Sponsored by NASA (For availability see N76-29287 20-09)
CSCL 14B

N76-29296 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
BENEFITS OF FLIGHT SIMULATION WORK FOR THE DEFINITION, LAYOUT, AND VERIFICATION WITH HARDWARE IN THE LOOP, OF THE MRCA FLIGHT CONTROL SYSTEM
W. Burkhardt, E. Zehner, and W. Duerr *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 20 p (For availability see N76-29287 20-09)

N76-29305 Cranfield Inst. of Technology (England). Dept. of Electronic and Control Engineering.
FEEL FORCE SYSTEM WITH AN INERTIA REDUCTION CAPABILITY
J. M. Lipscombe and D. J. G. Lewis *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

N76-29660 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
INTERACTION BETWEEN AIRCRAFT STRUCTURE AND COMMAND AND STABILITY AUGMENTATION SYSTEM
O. Sensburg *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 41-53 refs (For availability see N76-29656 20-39)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N76-29267# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
FIELD PERFORMANCE OF POUROUS FRICTION SURFACE COURSE Final Report, Dec. 1971 - Jun. 1975
Thomas D. White Apr. 1976 64 p refs
(Contract DOT-FA71WAI-218)

(AD-A025245/2; FAA-RD-74-38) Avail: NTIS HC $4.50 CSCL 01/5

The results of a field performance survey are presented. Additional prototype construction experience and validation of a design procedure including a desired mixing viscosity range are reported. Long term porous friction course (PFC) performance is recorded and combined with laboratory test results that provide data for a new recommended PFC gradation, water permeability requirements, and initial voids total mix requirement. Author

N76-29268*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYTICAL MODELS FOR ROTOR TEST MODULE, STRUT, AND BALANCE FRAME DYNAMICS IN THE 40 BY 80 FT WIND TUNNEL

Wayne Johnson Jun. 1976 18 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-73153; A-6692) Avail: NTIS HC $3.50 CSCL 14B

A mathematical model is developed for the dynamics of a wind tunnel support system consisting of a balance frame, struts, and an aircraft or test module. Data are given for several rotor test modules in the Ames 40 by 80 ft wind tunnel. A model for ground resonance calculations is also described. Author

N76-29269*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYSIS OF DATA RELATED TO THE MINIMUM TEMPERATURES FOR VALID TESTING IN CRYOGENIC WIND TUNNELS USING NITROGEN AS THE TEST GAS

Robert M. Hall Aug. 1976 110 p refs

(NASA-TM-X-73924) Avail: NTIS HC $5.50 CSCL 14B

The minimum operating temperature which avoids adverse low temperature effects, such as condensation, has been determined at a free stream Mach number of 0.85 for flow over a 0.137 meter airfoil mounted at zero incidence in the Langley 1/3 meter transonic cryogenic tunnel. The onset of low temperature effects is established by comparing the pressure coefficient measured at a given orifice for a particular temperature with those measured at temperatures sufficiently above where low temperature effects might be expected to occur. The pressure distributions over the airfoil are presented in tabular form. In addition, the comparisons of the pressure coefficient as a function of total temperature are presented graphically for chord locations of 0, 25, 50, and 75 percent. Over the 1.2 to 4.5 atmosphere total pressure range investigated, low temperature effects are not detected until total temperatures are 2 K, or more, below free stream saturation temperatures. Author

N76-29270# National Aviation Facilities Experimental Center, Atlantic City, N.J.

RECOMMENDED IMPROVEMENTS FOR TRANSMISSOMETER INSTALLATIONS Final Report, Jun. - Nov. 1974

Warren Smith Apr. 1976 29 p refs

(AD-A024476/4; FAA-NA-75-35; FAA-RD-75-167) Avail: NTIS HC $4.00 CSCL 01/5

Field reports of operational deficiencies in the type FA 7861 transmissometer were investigated in order to define problem areas. Contingent with defining the problems, solutions were sought to eliminate or minimize the problems. Weather-related transmissometer outage reports, and questionnaires on transmissometer RVR outages were reviewed. Results indicate that the transmissometer system is reliable, but requires constant attention. Major problems are: (1) contamination of the projector lamp, (2) inability of the system to self-calibrate, and (3) snow in the receiver barrel. Recommended solutions for these problems are: (1) use of a redesigned hood assembly for increasing projector protection, (2) use of a portable laser system, now in production, for calibration, and (3) use of wind baffles and/or heavy-duty purging blowers for receiver protection. Minor problem areas and possible solutions are also discussed. Author

N76-29271# ARO, Inc., Arnold Air Force Station, Tenn.

STATIC STABILITY AND AXIAL FORCE TESTS OF THE HOLLOMAN MONORAIL ROCKET SLED AT MACH NUMBERS 8 AND 10 Final Report, 15 Jan. - 9 May 1975

R. W. Rhudy and J. D. Corce AEDC Feb. 1976 32 p refs

(AD-A021391; ARO-VKF-TR-75-122; AEDC-TR-75-122) Avail: NTIS CSCL 14/2

Experimental static-stability and axial-force data are presented for several configurations of a 0.4-scale model of a monorail rocket sled at Mach numbers of 8 and 10. The test Reynolds numbers, based on maximum model length, were approximately 14.4 and 10.7 million, respectively. The models were tested in close proximity to a ground plane assembly which simulated the rail and trough of the Holloman AFB High-Speed Test Track. Results are presented to show the effects of configuration variables such as nose shape; vertical, forward, and aft canards; rocket booster chamber length; and forward and aft slipper wedges. GRA

N76-29272# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

A FACILITY AND METHOD FOR EVALUATION OF THERMAL PROTECTION

A. Stoll, L. R. Munroe, M. A. Chianta, J. R. Piergallini, and D. E. Zaccaria 1 Dec. 1975 20 p refs

(AD-A021234; NADC-75286-40) Avail: NTIS CSCL 14/2

The facility described is a fuel fire pit with ancillary equipment and instrumentation to provide for exposure of full-scale, clothed manikins to total flame envelopment under precisely controlled conditions. The method is designed to yield predictions of the proportion of surface area of a living subject expected to be burned under the experimental garment given the same exposure conditions. The ultimate purpose of the procedure is to provide realistic evaluations of the protective capacity of personal gear worn by aircrew personnel subjected to the hazard of fire contact, particularly that occasioned by aircraft in carrier deck crashes. GRA

N76-29273# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

PRELIMINARY TESTS OF GLOSS-REDUCTION AND COLORING AGENTS FOR CAMOUFLAGE OF POLYVINYL ACETATE DUST-CONTROL FILM Final Report, Jul. 1974 - Jun. 1975

Clarence R. Styron, III and Eugene E. Addor Feb. 1976 24 p refs

(DA Proj. 1A7-62719-AT-40)

(AD-A021652; WES-MP-M-76-1) Avail: NTIS CSCL 01/5

The purpose of the work reported herein was to search for possible means for reducing the glassiness of the cured PVA surface, used for dust-control on airstrips with the possibility for adding camouflage coloration also considered. A formula was found for mixing colored chalk dust (marking chalk powder) with DCA-1295 concentrate to produce an emulsion that can be painted (brushed, rolled, or sprayed) on the cured, in-place PVA film, and that cures to a tough, nonglossy, colored surface. This formulation formed a good bond with the cured film, and in a field test withstood direct sun and weather for 11 months, well beyond the 6-month design life of the film. In addition, this formulation was also applied, with satisfactory results, to a cured DCA-1295 film (without the fiberglass reinforcement) previously spray-coated onto metal landing mat and fiber membrane. None of the experimental substances produced satisfactory results when admixed directly with the DCA-1295 emulsion for direct application to the fiberglass scrim during initial installation. GRA

N76-29274# ARO, Inc., Arnold Air Force Station, Tenn.

ANALYSIS, DESIGN, AND TESTING OF COMPONENTS OF A COMBINED ABLATION/EROSION NOZZLE Final Report, 1 Jul. 1973 - 30 Jun. 1975

K. P. Fewell AEDC Mar. 1976 57 p refs

(AD-A021963; ARO-PWT-TR-75-107; AEDC-TR-75-154) Avail: NTIS CSCL 14/2

An analytical and experimental study was made of the feasibility of developing a combined ablation and erosion test facility. A facility concept was developed in which particles are accelerated to high velocities in a light-gas expansion nozzle, followed by injection into an adjacent jet by inertial transfer across a mixing layer. A detail design was completed of a facility which utilizes a state-of-the-art arc-heated airflow and a helium expansion nozzle to produce 4,000 -to 5,000-ft/sec particle velocities in a flow having an impact pressure of 80 atm. A cold-flow version of this facility was designed, fabricated, and

operated to provide initial experience with the new configuration. Author (GRA)

N76-29275# Air Force Civil Engineering Center, Tyndall AFB, Fla.
ANALYSIS OF THE STANDARD USAF RUNWAY SKID RESISTANCE TESTS Final Report, Jul. 1973 - Dec. 1974
John H. Williams May 1975 252 p refs
(AD-A021959; AFCEC-TR-75-3) Avail: NTIS CSCL 01/5

Data gathered during the Air Force Civil Engineering Center (AFCEC) standard skid resistance surveys conducted on 56 runways during the period November 1973 to September 1974 are analyzed. This report outlines the major milestones leading up to the present AFCEC program to determine runway skid resistance characteristics; refinements made to the program, description of equipment used to determine runway skid resistance characteristics, operating and test procedures and analysis of the skid measurement program. Author (GRA)

N76-29276# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARISON OF TWO- AND THREE-DIMENSIONAL TRANSONIC TESTS MADE IN VARIOUS LARGE WIND TUNNELS
Xavier Vaucheret, Maurice Brazin, and Claude Armand 10 Feb. 1976 42 p refs Transl. into ENGLISH from Office National d'Etudes et de Recherches Aerospatiales, (France), no. 1, 1975 p 1.1-1.14
(AD-A021348; FTD-IDRSI-0068-76) Avail: NTIS CSCL 14/2

A critical study is reported of testing conditions at transonic speeds and of the validity of the data obtained in various Wind-Tunnels. In two dimensional flow, two models of NACA 0012 and supercritical profiles have been tested as well as three homothetical profiles of NACA 0012. In three dimensional flow, four homothetical models of a typical transport aircraft were successively tested in twelve transonic tunnels commonly used for development tests in various countries. The data are compared in a broad range of Reynolds number (0.3 to 7 millions) between Mach number 0.7 and 0.96. GRA

N76-29277# Naval Training Equipment Center, Orlando, Fla.
EVALUATION OF AN AUTOMATED FLIGHT TRAINING SYSTEM: GROUND CONTROLLED APPROACH MODULE (GCAM) Final Report, Jun. 1974 - Jan. 1976
Joseph A. Puig and Susan Gill Feb. 1976 68 p refs
(NAVTRAEQUIPCEN Proj. 4751-03)
(AD-A021533; NAVTRAEQUIPC-IH-264) Avail: NTIS CSCL 05/9

An experiment was conducted to determine the effectiveness of an automated, adaptive system in training Naval aviators to fly ground controlled approaches (GCA's). The training course was comprised of seven different types of GCA's arranged in order of increasing difficulty. The GCA Module (GCAM) was integrated with a TA-4J Operational Flight Trainer (Device 2F90). Comparison of automated and conventional training was made. In general, the hypothesis was comfirmed that training with the automated system would be as effective as conventional instructor training. GRA

N76-29278# DOD Aircraft Ground Fire Suppression and Rescue Office, Wright-Patterson AFB, Ohio.
FEASIBILITY STUDY OF UNSTEADY FOAM GENERATORS Final Report, 1 Jul. 1974 - 30 Jun. 1975
Hermann Viets, Delbert Balster, and Howard L. Toms, Jr. Dec. 1975 45 p refs
(AF Proj. 7116)
(AD-A021485; DOD-AGFSRS-75-6) Avail: NTIS CSCL 01/2

A feasibility study was performed to examine the potential of employing an unsteady jet as the primary element in an aircraft fire suppression foam generator. The unsteady jet was controlled by fluidic means and contained no moving parts. Test results indicate an improved spreading rate of the unsteady jet and the possibility of producing a substantial amount of foam without contact between the primary flow and the mixing chamber walls. Further full scale tests are recommended. GRA

N76-29279# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Development Planning.
AIR FORCE MASTER PLAN - SIMULATORS FOR AIRCREW TRAINING Final Report
D. S. Dunlap and Richard E. Worthey Dec. 1975 55 p refs
(AD-A021576; ASC/XR-TR-75-25) Avail: NTIS CSCL 14/2

The application of simulators for aircrew training in the United States Air Force is addressed. Major operating commands provided current and projected requirements for aircrew training simulators for incorporation into formal training programs together with estimates of their impact on flight training. A simulator technology overview is provided and a technology research program is proposed to support future acquisitions. Estimates of program costs are made and the magnitude of potential direct operating costs and fuel savings are presented for each of the acquisition programs. Institutional and management problems are also addressed. GRA

N76-29280# Harry Diamond Labs., Adelphi, Md.
DEVELOPMENT OF A 7 INCH AIR GUN FOR USE IN INTERIOR BALLISTICS SIMULATION
Michael G. Otten Oct. 1975 50 p refs
(AD-A020866; HDL-TM-75-13) Avail: NTIS CSCL 14/2

A 7-in. diameter, 98-ft-long air gun has been installed at the Harry Diamond Laboratories (HDL) for use in fuze testing. The air gun is bidirectionally interfaced to a timeshare computer that acts as the test controller and promptly records test data. Streak photographs taken of the simulated ballistic environment are reduced by a computer-controlled microdensitometer. The resulting digital data are further computer analyzed to provide velocity versus time and acceleration versus time profiles of the test environment. This report details the purchase, inspection, acceptance, and construction of the 7-in. air gun. Instrumentation and data reduction procedures are described. To date, 34 air-gun shots have been made. Projectile velocities up to 530 ft/sec have been attained. Average impact test accelerations of 15 kg from 1.2 to 1.5 msec in duration have been achieved. GRA

N76-29281# Battelle Columbus Labs., Ohio. Tactical Technology Center.
FEASIBILITY OF A NAP-OF-THE-EARTH TRAINER USING A QH-50D REMOTELY PILOTED HELICOPTER AND SYNTHETIC FLIGHT TRAINING SYSTEM Final Report
D. W. Welp, A. S. Chace, and F. A. Tietzel Dec. 1975 78 p refs
(Contract DAAH01-73-C-0142; ARPA Order 2238)
(AD-A022025) Avail: NTIS CSCL 01/3

The objective of the study was to examine the technical and cost feasibility of using a television instrumented remotely piloted helicopter (RPH) as part of a closed-loop helicopter crew Nap-of-the-Earth flight training system, coupled with a Synthetic Flight Training System. The study analyzed and determined the visual, display, motion system and computational (hardware and software) requirements for the SFTS. Requirements for the RPH airframe and avionics were developed. Evaluation of the QH-50D determined that it had sufficient performance capabilities to serve as the RPH. GRA

N76-29282# Naval Postgraduate School, Monterey, Calif.
A MODEL TO DIAGNOSE LEARNING OBSTACLES AND TO FACILITATE THE ADOPTION OF THE SI METRIC SYSTEM WITHIN ORGANIZATIONS M.S. Thesis
Nguyen Ngoc Quynh and Dang Diem Dec. 1975 124 p refs
(AD-A021788) Avail: NTIS CSCL 14/2

Since the recommendation in 1968 that the United States embark on a national program for conversion to the metric system, no effective or significant action has been taken by any organization to promote the metric conversion. Apparently no method or procedure has been developed to identify and overcome learning obstacles or organizational lag in the metric changeover. Based on surveys conducted by the authors in four organizations, in education and in the business sector, and in the light of recent theories of learning and innovation, this study formulates a model to diagnose learning obstacles and to accelerate the adoption of the metric system within organizations. GRA

N76-29283# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF AUTOFRETTAGING LOOSE LINERS INTO THICK SHELLS: THEORY AND EXPERIMENT Final

Report, Dec. 1972 - Oct. 1974
Dennis T. Akers and Gerald F. Gillis AEDC Mar. 1976 78 p refs
(ARO Proj. V45G)
(AD-A021781; ARO-VKF-TR-75-79; AEDC-TR-76-19) Avail: NTIS CSCL 19/1

Local cratering of the expensive, high-strength launch tubes of the AEDC 1,000-ft Hyperballistic Range (G) has occurred when sabots failed in the launch tube and allowed the model to impact the surface of the bore. The expense and long lead time required to replace such launch tubes necessitated the development of a repair technique to increase the life of the launch tube. The technique developed consists of honing the launch tube to a size large enough to reline with a low cost, low carbon, steel tube. The liner is autofrettaged into place; however, some difficulty has been experienced in predicting the pressure required to firmly seat the liners. The purpose of the study reported herein was to determine a more accurate way to predict adequate autofrettage pressures. In the work reported, a 10-in.-long section of a high-pressure launch tube was used to simulate the actual procedure. Contact pressure between the shell and the liner was monitored by means of strain gages cemented to the clearance; pressure level, pressure-holding time, outside diameter of the outer shell, and pressure cycling were considered. Of these variables only the pressure level and the outside diameter of the outer shell had any marked effect on liner seating. Author (GRA)

N76-29284# Cadre Corp., Atlanta, Ga.
AIR FORCE AERO PROPULSION LABORATORY COMPONENT TEST AIR FACILITY STUDY Final Report, 20 May 1974 - 20 Jun. 1975
Nick H. Primm and King McMullen Wright-Patterson AFB, Ohio AFAPL Oct. 1975 302 p
(Contract F33615-74-C-2032; AF Proj. 1997)
(AD-A020140; AFAPL-TR-75-56) Avail: NTIS CSCL 14/2

This report summarizes the study to analytically develop the design criteria, performance specifications, and operation and maintenance philosophies for an expanded Component Test Air Facility capable of supporting current and anticipated Air Force aero-propulsion RDT and E requirements at the Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio. The report also contains a complete estimate of the cost for expanding the facility and a work flow diagram for accomplishing this expansion with minimal disruption to RDT and E programs. GRA

N76-29285# Texas Univ., Austin. Applied Research Labs.
SYNC TESTER OPERATION INSTRUCTION
Dennis W. Feller 6 Jan. 1976 16 p refs
(Contract N60921-74-C-0217)
(AD-A021441; ARL-TM-76-2) Avail: NTIS CSCL 14/2

The sync tester is part of the Navigation, Tracking, and Communications(NTC) System located at Naval Surface Weapons Center Test Facility in Ft. Lauderdale, Florida. When properly connected, the sync tester displays the range error caused by a drift in synchronization circuits of various portable NTC range readers, beacons, and tracking pingers. This report covers the operation instructions and circuit diagrams of the sync tester. GRA

N76-29286# Texas Univ., Austin. Applied Research Labs.
OPERATING INSTRUCTIONS FOR THE UNIVERSAL SYNCED TRACKING PINGER AND TEST SET
Dennis W. Feller 6 Jan. 1976 27 p refs
(Contract N60921-74-C-0217)
(AD-A021442; ARL-TM-76-3) Avail: NTIS CSCL 14/2

This report contains the operation instructions for the universal synced tracking pinger (USTP) and its test set. The USTP is an addition to the Navigation, Tracking, and Communications (NTC) Systems located in Ft. Lauderdale, Florida. The USTP is a portable tracking pinger which can be used with any of the tracking system transducers. Included in this report are circuits schematics for both the USTP and the test set. GRA

N76-29287# Advisory Group for Aerospace Research and Development, Paris (France).
FLIGHT SIMULATION/GUIDANCE SYSTEMS SIMULATION
Jun. 1976 380 p refs Presented at the Joint Flight Mech. Panel/Guidance and Control Panel Symp., The Hague, 20-23 Oct. 1975
(AGARD-CP-198) Copyright. Avail: NTIS HC $10.75

Papers are presented dealing with the use of flight simulation techniques. Specific topics discussed include: (1) approach and blind landing; (2) aircraft design; and (3) military operations and missions such as air combat, weapon delivery, and mission training. The generation of motion, visual, and feel cues and turbulence models are also discussed. For individual titles, see N76-29288 through N76-29315.

N76-29288 British Aircraft Corp., Warton (England). Military Aircraft Div.
THE GROWING CONTRIBUTION OF FLIGHT SIMULATION TO AIRCRAFT STABILITY, CONTROL AND GUIDANCE PROBLEMS c08
A. G. Barnes *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

The changing role and contribution of the research/development simulator is discussed. It is a field of activity where rapid progress is being made, and the reasons for such progress are considered. In particular the advances which developments in TV based displays have brought are noted. Examples are given of the increasing range of problems now addressed on simulators, and some of the future trends are indicated. Author

N76-29289 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Human Engineering Dept.
A METHOD FOR THE GUIDANCE AND CONTROL SYSTEM EVALUATION FROM THE OPERATIONAL POINT OF VIEW c06
H. Denkscherz and P. Hahn *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 7 p (For availability see N76-29287 20-09)

A method is described for human engineering assessment of avionic systems. The method is based on the use of human engineering criteria for which examples are given. The way these criteria lead to system evaluation and system optimization is shown by examples. Author

N76-29290 Centre d'Essais en Vol, Istres (France).
INVESTIGATION OF THE LANDING APPROACHES FOR A STOL AIRCRAFT USING A FLIGHT SIMULATOR [ETUDE AU SIMULATEUR DU PILOTAGE D'UN AVION STOL EN APPROCHE] c08
J. P. Petit and J. C. Raynal (ONERA, Modane) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 15 p In FRENCH; ENGLISH summary (For availability see N76-29287 20-09)

The influence of instrumentation in the establishment of longitudinal handling qualities criteria for approach and flare was investigated. Velocity vector head-up display, IFR and VFR instrumentation were tested. Various types of STOL aircraft were defined by modification of the engine thrust static and dynamic characteristics and by modification of the lift coefficients, in order to give them various flight path margins and various flight path rates of change. The simulation methods used to define several STOL aircraft, the test program conducted, and the results obtained are described. Author

N76-29291 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
THE USE OF A FLIGHT SIMULATOR IN THE SYNTHESIS AND EVALUATION OF NEW COMMAND CONTROL CONCEPTS c08
R. Onken, V. Adam, and R. Dierke *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 16 p refs (For availability see N76-29287 20-09)

The introduction of digital electric flight control systems as well as new theoretical techniques in optimal control open new ways in overall design. In particular, the development of advanced command control systems offers great promise. A flight simulator is used as a design aid and as a means for exploratory and comparative investigations for the study of flight path command systems. Some results show the tracking performance achieved

with an optimized control law and suitably modified pilot interfaces. Author

N76-29292 Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
APPLICATION OF FLIGHT SIMULATION TO DEVELOP, TEST, AND EVALUATE THE F-14A AUTOMATIC CARRIER LANDING SYSTEM c04
Robert L. Fortenbaugh and James M. Rebel (NATC) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

In the development of a F-14A automatic carrier landing system, a moving-base simulator was utilized to replace portions of both computerized synthesis and flight test phases. The simulator proved to be a cost effective test and evaluation tool in that it was able to duplicate and predict flight test results, to receive pilot acceptance as a valid representation of the real airplane, and to provide significant increases and flexibility in the number of parameter combinations that could be examined by a pilot. Author

N76-29293 Societe Nationale Industrielle Aerospatiale, Toulouse (France). Dept. des Etudes de Qualites de Vol et de Pilotage.
SIMULATION TECHNIQUES AND METHODS USED FOR THE STUDY AND ADJUSTMENT OF THE AUTOMATIC LANDING SYSTEM ON THE CONCORDE SUPERSONIC TRANSPORT AIRCRAFT [MOYENS ET METHODES DE SIMULATION UTILISES POUR L'ETUDE ET LA MISE AU POINT DE L'ATTERRISSAGE AUTOMATIQUE DE L'AVION DE TRANSPORT SUPERSONIQUE CONCORDE] c08
Raymond Deque and Jean-Louis Bonafe *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 11 p In FRENCH (For availability see N76-29287 20-09)

After a brief presentation of flight simulation techniques, the utilization of the automatic landing system of the Concorde, breakdown consequences, and performance analysis are studied. A critical test of turbulence models is presented in the effective analysis of turbulences encountered in flight tests.
Transl. by B.B.

N76-29294 Boeing Aerospace Co., Seattle, Wash.
USE OF THE FLIGHT SIMULATOR IN YC-14 DESIGN c05
Robert E. Spitzer *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 14 p refs (For availability see N76-29287 20-09)

The twin-engine USAF/Boeing YC-14 STOL prototype is approaching the final stages of fabrication and assembly. With upper-surface-blowing powered lift, and triplex digital flight control system, the YC-14 represents a new generation of transport aircraft. The piloted flight simulator has served as an integral tool in the design process. The flight simulation work that supported and guided YC-14 development is described. Organization and features of the digital math model are discussed. The simulation includes powered-lift effects, engine bleed for leading edge BLC, mechanical and electrical flight control systems, aerial delivery modes, and a newly developed wind and turbulence model. The three main contributions of the simulator are covered: criteria development, control system definition, and validation of flying qualities. Criteria for engine-out STOL approach are discussed. Control laws were developed for conventional piloting techniques for STOL speed and flight path control. Satisfactory flying qualities were validated by Boeing, USAF, and NASA pilots for a wide range of flight conditions. It is concluded that the flight simulator is an invaluable tool in the design of advanced technology aircraft such as the YC-14. Author

N76-29295* Kansas Univ., Lawrence.
SIMULATION AND SIMULATOR DEVELOPMENT OF A SEPARATE SURFACE ATTITUDE COMMAND CONTROL SYSTEM FOR LIGHT AIRCRAFT c08
Jan Roskam *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 15 p refs Sponsored by NASA (For availability see N76-29287 20-09)
CSCL 14B

A detailed description is presented of the simulation philosophy and process used in the development of a Separate Surface Attitude Command control system (SSAC) for a Beech Model 99 Airliner. The intent of this system is to provide complete three axes stability augmentation at low cost and without the need for system redundancy. The system, although aimed at the general aviation market, also has applications to certain military airplanes as well as to miniature submarines. Author

N76-29296 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
BENEFITS OF FLIGHT SIMULATION WORK FOR THE DEFINITION, LAYOUT, AND VERIFICATION WITH HARDWARE IN THE LOOP, OF THE MRCA FLIGHT CONTROL SYSTEM c08
W. Burkhardt, E. Zehner, and W. Duerr *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 20 p (For availability see N76-29287 20-09)

Based on the description of the Primary Flight Control System of the MRCA the main system layout parameters are explained. The main benefits of software system simulation and layout are pointed out and their test results are illustrated. The subsequent hardware system integration work on a Flight Control Test Rig with open loop tests and closed loop tests combined with the computer aircraft simulation are demonstrated. Author

N76-29297 Air Force Flight Test Center, Edwards AFB, Calif.
SIMULATION IN SUPPORT OF FLIGHT TEST c05
Richard R. Hansen, Christopher J. Nagy, and Paul W. Kirsten *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 28 p (For availability see N76-29287 20-09)

The General Purpose Engineering Simulator (GPES) operated by the Air Force Test Center to support conventional aircraft and aerospace vehicle testing and developmental engineering is described. The GPES is a small simulator without motion or visual systems for somatic cueing. Two concurrent real-time man-in-the-loop simulations are provided by this system which includes hybrid and analog computers. This system is used in aircraft design modification, pilot familiarization, handling qualities investigations, and accident investigations among other engineering studies. A simple but accurate simulator such as the GPES has many advantages in an aircraft testing environment over more complex systems with motion and visual cues. Author

N76-29298 Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
A JOINT PILOT/LANDING OFFICER SIMULATION PERFORMED TO DETERMINE AIRCRAFT WAVE-OFF PERFORMANCE REQUIREMENTS c04
Ronald L. Nave *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 10 p refs (For availability see N76-29287 20-09)

A combined pilot/landing signal officer simulation was performed at the Naval Air Development Center in order to develop requirements for the wave-off performance of Naval aircraft. The simulator was also used to investigate the dynamic interaction between the pilot and landing signal officer. Thrust/weight ratio and wing loading were identified as being the most important aircraft parameters influencing wave-off performance. A wave-off performance requirement was developed which specified minimum values of aircraft normal acceleration as a function of trim airspeed and time after initiation of the wave-off maneuver. A minimum thrust/weight ratio of .4 and a maximum power approach wing loading of 90 lb/sq ft were recommended based on pilot opinion gathered in the simulation. In a separate LSO experiment it was determined that the landing signal officer could detect aircraft altitude errors during approach as small as 5 feet at 1/4 mile range. Author

N76-29299 Naval Air Test Center, Patuxent River, Md.
ON IMPROVING THE FLIGHT FIDELITY OF OPERATIONAL FLIGHT/WEAPON SYSTEM TRAINERS
Marle D. Hewett and R. Thomas Galloway *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

A team approach utilizing the complementary talents and expertise of Naval test pilots, flight test engineers, computer specialists, and simulator specialists from various Naval field activities is described. The approach is effective in improving the flight fidelity of existing Operational Flight Trainers and Weapon System Trainers and in guiding contractors in providing the best

fidelity possible in new flight simulators. Results obtained in several programs are presented. Author

N76-29300 Le Material Telephonique, Trappes (France).
RADAR LANDMASS SIMULATOR
Michel Dachery *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 8 p (For availability see N76-29287 20-09)

The radar landmass simulator is used at all levels in the training of pilots and radar navigators: basic training, conversion training, continuation and improver training; and navigation exercises at high and low altitudes. The simulator has an operational use from its ability to provide radar prediction maps. The principle and organization of this type of simulator, its qualities of flexibility and accuracy, and its applications are described. Author

N76-29301 Ecole Nationale Superieure de l'Aeronautique et de l'Espace, Toulouse (France).
SIMULATION OF A VISUAL AID SYSTEM USED FOR THE PILOTING OF HELICOPTERS IN FORMATION FLYING **c04**
J. H. Llareus, A. J. Fossard, M. Clique (Centre d'Etudes et de Recherches, Toulouse), and N. Imbert (Centre d'Etudes et de Recherches, Toulouse) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 14 p refs In FRENCH (For availability see N76-29287 20-09)

Real time simulation of a system used to aid the piloting of a helicopter, permitting it to fly in formation in hazardous weather conditions is presented. The leader arranges the navigation paths; the crew plots the distance and level of the preceding helicopter with the aid of a radar detection system. The simulation introduces the requirement of a human pilot who, with the help of a micromanipulator, provides orders of cyclic paths, longitudinal and lateral, determining the evolutions of a helicopter crew stationed at a digital computer. Transl. by B.B.

N76-29302 Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
THE INFLUENCE OF VISUAL EXPERIENCE AND DEGREE OF STYLIZATION ON HEIGHT AND DISTANCE JUDGEMENT IN AIRCRAFT APPROACH SCENES
Gert Doerfel *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 9 p refs (For availability see N76-29287 20-09)

The technical development of the visual system of a flight simulator is considered. The basic problem is to determine to what extent the external scene might be simplified and stylized, while still presenting enough of the required information to the pilot for the landing approach. Experimental results which help to establish the human engineering visual requirements for the visual simulator being developed are given. Author

N76-29303 Royal Aircraft Establishment, Bedford (England).
DIGITALLY GENERATED OUTSIDE WORLD DISPLAY OF LIGHTING PATTERN USED IN CONJUNCTION WITH AN AIRCRAFT SIMULATOR
J. C. Penwill *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 12 p refs (For availability see N76-29287 20-09)

The main features are described of a digitally generated outside world display along with its uses as part of a flight simulation facility to support research programs concerned with all weather operations. The picture presented to the pilot is a view of airfield approach and runway lights as seen at night. The view is collimated to infinity by the use of a simple, low cost, concave mirror and can be seen by all crew members on the fixed base cockpit. The basis of the system is a digital computer used to generate the perspective picture and a specially developed television camera using a frame sequential technique which, together with a modified monochrome projector, presents a color display to the pilot. The system provides a very cost effective simulation of low visibility conditions. Author

N76-29304 National Aerospace Lab., Amsterdam (Netherlands).
DESIGN AND PERFORMANCE OF THE FOUR-DEGREE-OF-FREEDOM MOTION SYSTEM OF THE NLR RESEARCH FLIGHT SIMULATOR
W. P. Koevermans and C. J. Jansen *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 11 p (For availability see N76-29287 20-09)

The motion system of the NRL research flight simulator with freedom of motion in heave, roll, pitch and yaw is described. To give good motion cues, smooth operation without any jerks is required. To this end specific hydraulic jacks were developed in which stick-slip phenomena are eliminated by introducing hydrostatic bearing between the moving piston and rod and the fixed cylinder, resulting in an acceleration threshold level below 0.01 g. A mathematical model was prepared to simulate and study the behavior of the hydraulic jacks. Results are given of measurements on single jacks and the complete system, comprising acceleration noise and threshold level, dynamic response and performance diagrams. Because of the required oil pressure for the hydrostatic bearing, special procedures have to be followed to start and stop the operation of the system. A description is given of the principles of the safety system applied. Author

N76-29305 Cranfield Inst. of Technology (England). Dept. of Electronic and Control Engineering.
FEEL FORCE SYSTEM WITH AN INERTIA REDUCTION CAPABILITY **c08**
J. M. Lipscombe and D. J. G. Lewis *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 13 p refs (For availability see N76-29287 20-09)

The design, construction, and test of a single and twin stick feel force system is described. The systems have the usual variable feel characteristics of stiffness, damping, backlash, Coulomb friction and breakout force; and also a variable inertia, so that the effective inertia can be increased to more than the stick inertia, or reduced to a small proportion of the stick inertia. Parameter plane design techniques are applied to a high order mathematical model of the system, and a digital computer and visual display unit are used in interactive mode, to evaluate and plot the locus of the parameters of the system for any desired pole and zero locations on the s-plane. The performance of the model is then compared to the performance of the system under test. Author

N76-29306 Royal Aircraft Establishment, Bedford (England). Flight Systems Dept.
DEVELOPMENTS IN THE SIMULATION OF ATMOSPHERIC TURBULENCE
B. N. Tomlinson *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 14 p refs (For availability see N76-29287 20-09)

In ground-based simulation of aircraft flight, inclusion of atmospheric turbulence is essential to the successful evaluation of handling and ride qualities, and to the creation of a realistic subjective environment and representative pilot workload. A new model of atmospheric turbulence capable of generating time-histories which reproduce the essential discrete-gust and non-Gaussian features of turbulence is described. A principal aim of the model is to reproduce the quality of 'intermittency' identified in real atmospheric turbulence from the non-Gaussian distributions of velocity differences. Qualitatively, intermittency appears in a turbulence record as relatively isolated large changes in gust velocity embedded in a background of low activity. Comparison with flight measurements of atmospheric turbulence shows that power spectra, intermittency, and discrete gust content are accurately reproduced by the model. A parameter in the model enables intermittency to be controlled explicitly and matched to a variety of weather conditions and terrain. Experiments in a simulator have shown acceptance by pilots, but credible simulation of turbulence and its effects requires a high quality motion system. The model exists as a FORTRAN computer program and as an analogue hardware device. Although orginally concerned with 'pilot-in-the-loop' simulation, the model of turbulence described has relevance and application in other areas, such as certification trials of automatic landing equipment. Author

N76-29307 Technische Hogeschool, Delft (Netherlands).
SIMULATION OF PATCHY ATMOSPHERIC TURBULENCE, BASED ON MEASUREMENTS OF ACTUAL TURBULENCE
G. A. J. VanDeMoesdijk *In* AGARD Flight Simulation/Guidance

Systems Simulation Jun. 1976 14 p refs (For availability see N76-29287 20-09)

Pilot dissatisfaction with the characteristics of Gaussian simulated turbulence in flight simulation stimulated a research program to determine the relevant non-Gaussian aspects of actual atmospheric turbulence needed in a realistic turbulence simulation. A model describing the so-called patchy characteristics of atmospheric turbulence as sensed by the pilot is developed in which the degree of patchiness is defined in mathematical terms. Results of actual measurements of patchy characteristics analyzed in a method indicated by the model are compared to the model characteristics. Finally a digital simulation of real-time patchy turbulence velocities is presented. Author

N76-29308* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTERACTIVE COMPUTERIZED AIR COMBAT OPPONENT

c05

Walter W. Hankins, III *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 9 p (For availability see N76-29287 20-09)

CSCL 01C

A computer program developed to fly interactive one-on-one simulated air combat maneuvers against human pilots is described. The program which is called Adaptive Maneuvering Logic (AML), is being used in the National Aeronautics and Space Administration (NASA) Langley Research Center's Differential Maneuvering Simulator. The basic control logic evaluates the relative states of the two aircraft and reacts by choosing the best of several elemental maneuvers. Pilot comments and results obtained when the computer was flown against combat-qualified fighter pilots indicate that the program performs realistic maneuvers and offers a very competitive standard pilot. Author

N76-29309 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

ANALYSIS OF AIR-TO-AIR MISSILE REQUIREMENTS AND WEAPONS SYSTEMS EFFECTIVENESS IN AN AIR-COMBAT MANEUVERING ENVIRONMENT

D. L. Gieseking, J. H. Simpson, and J. W. Oestreich (NWC) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 9 p (For availability see N76-29287 20-09)

A simulation developed to aid in air-to-air missile system requirements analysis, missile subsystem design, and weapon system effectiveness is described. The air combat analysis (ACA) simulation was developed in support of advanced Navy air-to-air missile programs to offer improved design techniques for use with highly effective missiles. The ACA simulation brings added realism into the design process by introducing the combat environment as an independent input into the simulation. The combat environment is introduced by using mock combat aircraft trajectories (hassle) or manned cockpit simulation trajectories as initial conditions for missile firings. To illustrate the capability of the ACA simulation, sample analyses are discussed which demonstrate requirements analysis, subsystem design, and weapon system effectiveness. The preprocessing of the aircraft hassle data and the initialization of the missile simulation, the detail involved in the simulation itself, and the postprocessing of the simulation data to give intercept performance, failure summary, and terminal geometry, are described. Author

N76-29310 LTV Aerospace Corp., Dallas, Tex.

AIR COMBAT MANEUVERING TRAINING IN A SIMULATOR

Charles W. Meshier and Gregory J. Bulter (Tactical Air Command, Langley AFB, Va.) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 10 p refs (For availability see N76-29287 20-09)

The Tactical Air Command Aerial Combat Engagement Simulation (TAC ACES) is an attempt to use a fixed-base visual fighter simulator as a training device to improve combat skills. The program is structured to optimize the amount of training with simulation state of the art, such that it will enhance the flight syllabus, not replace it. The trainer configuration was developed from a review of U.S industry and National Aeronautics and Space Administration (NASA) facilities. Instructional facilities were added to permit comprehensive monitoring of simulated combat with appropriate controls. In addition, a system of automated grading is provided, summarizing each student's performance through the use of a digital, computer-produced printout and finally, to teach the course, a flight training syllabus was developed for the simulator. Pilot skills, safety and potential savings are tangible assets, of course, but the more subjective opinions of pilots and instructors are sampled too. Author

N76-29311 McDonnell Aircraft Co., St. Louis, Mo.

APPLICATION OF MANNED AIR COMBAT SIMULATION IN THE DEVELOPMENT OF FLIGHT CONTROL REQUIREMENTS FOR WEAPON DELIVERY

J. B. Berger, R. P. Meyer, and David L. Carleton (AFFDL) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 20 p refs (For availability see N76-29287 20-09)

(Contract F33615-73-C-3122)

Manned air combat simulations were conducted to develop requirements for tactical advanced aircraft/weapon systems in which precision tracking and weapon delivery are optimized through flight control system design. The objectives were to (1) develop analytical pilot models that relate weapon delivery accuracy to the entire integrated aircraft/displays/sight/geometry system for air-to-air and air-to-ground weapon delivery tasks, (2) validate and incorporate these pilot models into the Terminal Aerial Weapon Delivery Simulation (TAWDS) digital computer program, and (3) use the TAWDS program to determine how aircraft flying qualities affect air-to-air gunnery, and air-to-ground gunnery and bombing weapon delivery effectiveness. The TAWDS program enables a digital simulation to be performed on various closed loop weapon delivery systems under manual tracking control for predicting and evaluating weapon delivery accuracy. Tracking performance results, acquired from analytical pilot simulations, are compared with those obtained from the manned simulations, and the Tactical Weapon Delivery (TWeaD) flight test development programs. These results indicate that the judicious use of the all-digital analytical weapon delivery program in conjunction with manned simulation studies provides a very cost effective approach in designing, developing, and optimizing advanced aircraft/weapon delivery systems. The evaluation of flying qualities for piloted advanced aircraft, performing air-to-ground weapon delivery tasks in terms of weapon system effectiveness, is shown to be feasible for determining and establishing flight control requirements. Author

N76-29312 Litton Systems, Inc., Woodland Hills, Calif.

DEVELOPMENT OF A SYSTEM FOR SCORING SIMULATED BOMBING RUNS

J. S. Ausman and F. J. Hellings (6585th Test Group) *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 19 p ref (For availability see N76-29287 20-09)

A Bomb Scoring System (BSS) to be used in evaluating radar bombing capabilities of F-111 and A6 aircraft was developed. The BSS consists of an inertial navigation system updated with precision range and range-rate measurements to a set of 2 to 4 ground transponders placed in close proximity to the target. A pod contains the airborne equipment (inertial navigation system and range/range-rate interrogator) and attaches to a standard weapon station on the aircraft. While the aircraft makes its (simulated) bombing run, the BSS pod continually monitors its position and velocity relative to the target. The aircraft's weapon delivery system sends its release pulse to the weapon station which holds the BSS pod. Subsequently, the computer predicts where the bomb would have landed if one had actually been released. Bomb impacts and other pertinent data are stored in memory for immediate readout when the airplane returns to base. Author

N76-29313 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

WASI: WEAPON AIMING TRAINING SIMULATOR INSTALLATION

Uwe Schulz *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 10 p (For availability see N76-29287 20-09)

An inflight training system for the squadron training of pilots is defined. The system provides realistic training in ground attack with simulated bombs, cannons, and rockets on a range or in tactical settings without the restrictions normally imposed by

safety considerations, shortage of training ammunition, lack of availability of live firing ranges, etc. The system is self-contained within a standard modified drop-tank (WASI-POD), with the absolute minimum of mechanical and electrical interfaces. It provides an immediate indication to the pilot of miss distance and direction, while the most important parameters of the action are recorded on tape for subsequent play-back and analysis on the ground equipment. The WASI is suitable for basic training, refresher training, as well as continuous realistic tactical training. A detailed description of the system is given including some aspects concerning the future applications in the training for the air-air firing and dog fights. Author

N76-29314 Royal Netherlands Air Force, The Hague.
PROFICIENCY TRAINING OF PILOTS AND CONTROLLERS PARTICIPATING IN RNLAF MISSIONS BY THE USE OF A SIMULATOR
J. Alwon *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 4 p (For availability see N76-29287 20-09)

Simultaneous training of pilots and mission controllers by coupling a ground-based simulator with a radar control center is reported. The flight training simulator is briefly described. Results of pilot training and mission controller simulation are given. J.M.S.

N76-29315 Ministry of Defence, London (England).
RESEARCH INTO THE TRAINING EFFECTIVENESS OF A FULL MISSION FLIGHT SIMULATOR
Graham Shepherd *In* AGARD Flight Simulation/Guidance Systems Simulation Jun. 1976 17 p (For availability see N76-29287 20-09)

The training effectiveness of flight simulators is examined. An objective measure of aircrew performance is developed for use in long term streaming trails. Interim results for a number of flight profiles indicate the feasibility of deriving an objective measure of performance from recorded flight data and instructor assessments using linear multiple regression techniques. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-29316*# Sperry Rand Corp., Huntsville, Ala.
ATMOSPHERIC CLOUD PHYSICS LABORATORY PROJECT STUDY Final Report
W. E. Schultz, L. A. Stephen, and L. H. Usher 22 Jun. 1976 40 p ref
(Contract NAS8-32016)
(NASA-CR-149956) Avail: NTIS HC $4.00 CSCL 22A

Engineering studies were performed for the Zero-G Cloud Physics Experiment liquid cooling and air pressure control systems. A total of four concepts for the liquid cooling system was evaluated, two of which were found to closely approach the systems requirements. Thermal insulation requirements, system hardware, and control sensor locations were established. The reservoir sizes and initial temperatures were defined as well as system power requirements. In the study of the pressure control system, fluid analyses by the Atmospheric Cloud Physics Laboratory were performed to determine flow characteristics of various orifice sizes, vacuum pump adequacy, and control systems performance. System parameters predicted in these analyses as a function of time include the following for various orifice sizes: (1) chamber and vacuum pump mass flow rates, (2) the number of valve openings or closures, (3) the maximum cloud chamber pressure deviation from the allowable, and (4) cloud chamber and accumulator pressure. Author

N76-29317*# Howard Univ., Washington, D.C. School of Engineering.
EXTENDED ANALYSIS OF SKYLAB EXPERIMENT M558 DATA Final Report
Anthony O. Ukanwa Jun. 1976 37 p refs
(Contract NAS8-31605)
(NASA-CR-149958) Avail: NTIS HC $4.00 CSCL 22A

A careful review of the data from Skylab M558 was made in an effort to explain the apparent anomaly of the existence of radial concentration gradients whereas none should bave been observed. The very close modelling of the experimental axial concentration profiles by the unsteady-state one-dimensional solution of Fick's Law of self-diffusion in liquid zinc, and the condition of initial uniform concentration in the radioactive pellet portion of the experimental specimens would have precluded the appearance of such radial concentration gradients. Statistical analyses were used to test the significance of the observed deviation from radial-concentration homogeneity. A student t-distribution test of significance showed that, at 90% or even at 80% level of significance, there were no significant deviations from uniformity in radial concentrations. It was also concluded that the two likely causes of any deviation that existed were the zinc to zinc-65 bonding procedure and surface phenomena such as surface tension and capillary action. Author

N76-29318*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, May - Jun. 1976
15 Aug. 1976 157 p refs
(Contract NAS7-100)
(NASA-CR-148594; JPL-PR-42-34) Avail: NTIS HC $6.75 CSCL 14B

Various ongoing projects within the Deep Space Network are discussed, including mission support, communications, data processing, and network operations. For individual titles, see N76-29319 through N76-29338.

N76-29319* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1976 p 1-3 (For availability see N76-29318 20-12)
CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N76-29320* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT c14
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Aug. 1976 p 4-20 (For availability see N76-29318 20-12)
CSCL 22D

The final operations tests prior to Mars orbit insertion for Viking 1 are discussed together with the real-time operations support for the two months preceding this event. Several special operational strategies and procedures designed to optimize the DSN support during the critical planetary phases of the mission are described. The final phases of Network implementation for Viking and the support afforded to the radio science experiments and Mars radar observations are also included. Author

N76-29321* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin, W. G. Meeks, and R. E. Morris *In its* The Deep Space Network 15 Aug. 1976 p 21-32 refs (For availability see N76-29318 20-12)
CSCL 22D

The successful flight of the Helios-1 spacecraft continues as it approaches its third aphelion. The Helios-2 spacecraft has entered its first superior conjunction and continues in excellent health. Much valuable scientific information about the solar corona and its effects on electromagnetic waves is expected to be learned from data gathered during this superior conjunction. Author

N76-29322* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION OF SPACECRAFT SIGNAL RAYPATH TRAJECTORIES RELATIVE TO THE SUN c17
A. R. Cannon and C. T. Stelzried *In its* The Deep Space Network 15 Aug. 1976 p 33-38 ref (For availability see N76-29318 20-12)
CSCL 20N

An updated double-precision computer program was developed to determine the trajectory of a spacecraft telemetry signal raypath relative to the sun. Using trajectory information available

on DPTRAJ save tapes, the program efficiently and accurately computes the desired raypath trajectory and delivers the results in the form of plots, punched cards, and a tabular listing. Author

N76-29323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELECOMMUNICATIONS DIVISION FOURTH HARMONIC POWER ANALYZER **c17**
C. Foster *In its* The Deep Space Network 15 Aug. 1976 p 39-46 refs (For availability see N76-29318 20-12)
CSCL 09C

A microprocessor-based instrumentation system was developed to be used in the measurement and analysis of fourth harmonic power generated by the DSN high-power transmitters. Author

N76-29324* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DECODING WITH MULTIPLIERS **c61**
L. D. Baumert, R. J. McEliece, and G. Solomon (UCLA) *In its* The Deep Space Network 15 Aug. 1976 p 43-46 refs (For availability see N76-29318 20-12)
CSCL 09B

A general technique, called decoding with multipliers, is presented that can be used to decode any linear code. The technique is applied to the (48,24) quadratic residue code and yields the first known practical decoding algorithm for this powerful code. Author

N76-29325* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODC2 PROCEDURES FOR ASSEMBLY OF MODCOMP-2 PROGRAMS USING THE SIGMA 5 ASSEMBLER **c61**
J. W. Layland *In its* The Deep Space Network 15 Aug. 1976 p 47-53 refs (For availability see N76-29318 20-12)
CSCL 09B

A set of programs was written to enable the METASYMBOL macro-assembler of the Sigma 5 to assemble programs for an attached MODCOMP-2 minicomputer. This program set is a follow-on to previously developed program sets which facilitated assemblies for the PDP-11 and SDS-930. Author

N76-29326* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIPLEX, PIPELINED FFT **c60**
R. F. Emerson *In its* The Deep Space Network 15 Aug. 1976 p 54-59 ref (For availability see N76-29318 20-12)
CSCL 09B

A method of implementing a pipelined fast Fourier transform (FFT) is presented that makes full use of the elements that comprise it. For a given bandwidth and spectral resolution, this approach requires 25 percent less memory, and needs only half the logic speed required for the conventional implementation. Since the spectrum is broken into two parts, two analog-to-digital converters, and attendant mixer-filters, are needed. These two input elements need only operate at half the speed of the one they replaced. Author

N76-29327* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING TELECOMMUNICATION EFFECTS OF GEOS SATELLITE INTERFERENCE BASED ON TESTING AT THE MADRID DEEP SPACE STATION **c17**
F. V. Stuhr, S. S. Kent, J. L. Galvez, B. G. Luaces, G. R. Pasero, and J. M. Urech *In its* The Deep Space Network 15 Aug. 1976 p 60-74 ref (For availability see N76-29318 20-12)
CSCL 17B

In support of the ongoing NASA-European Space Agency (ESA) effort to understand and control possible interference between missions, testing was conducted at the Madrid Deep Space Station from July 1975 to February 1976 to characterize the effect on Viking 1975 telecommunication link performance of Geodetic Earth-Orbiting Satellite (GEOS) downlink signals. The prime use of the data was to develop a capability to predict GEOS interference effects for evaluation of Viking 1975 mission impacts and possible temporary GEOS shutdown. Also, the data would serve as a basis for assessment of the GEOS impact on missions other than Viking as well as for more general interference applications. Performances of the reference receiver, telemetry, and planetary ranging were measured in the presence of various types of GEOS-related interference, including an unmodulated GEOS carrier and simulation of the actual spectrum by an ESA-supplied GEOS suitcase model. Author

N76-29328* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN STANDARD INTERFACE ADAPTER AND BUFFER ASSEMBLY USED IN THE MARK 3 DATA SYSTEM **c60**
T. Anderson *In its* The Deep Space Network 15 Aug. 1976 p 75-83 (For availability see N76-29318 20-12)
CSCL 09B

The DSN Standard Interface Adapter and Buffer Assembly (referred to as the 900/SIA) is used to effect interface compatibility between the Xerox data systems 920 computer (XDS 920) and the Mark 3 data system (MDS) processors. It sets forth the requirements based on the differences between the two systems. Operational characteristics and general design strategy are described, as well as certain efficient implementation techniques used. From a software standpoint, the transfer protocol is discussed to a level of detail sufficient for its operation. Author

N76-29329* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW SEQUENTIAL DECODER FOR THE DSN TELEMETRY SUBSYSTEM **c61**
J. H. Wilcher *In its* The Deep Space Network 15 Aug. 1976 p 84-87 (For availability see N76-29318 20-12)
CSCL 09B

A sequential decoder was implemented in the DSS telemetry subsystem for the DSN MARK 3 data system implementation. This decoder performs the same decoding function as the data decoder assembly performs in the telemetry and command data handling subsystem. However, the new decoder is much faster, allowing potentially high data rates in the future. Author

N76-29330* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA POINTING SUBSYSTEM CONSCAN IMPLEMENTATION **c61**
R. Tappan *In its* The Deep Space Network 15 Aug. 1976 p 88-89 (For availability see N76-29318 20-12)
CSCL 09B

The software of the computer that drives the tracking antennas in the DSN was modified to improve the pointing accuracy for tracking operations at X-band frequencies. The change implemented an improved model for atmospheric refraction correction and added a software tracking option that corrects any remaining pointing errors. The software tracking option that was added measures the actual pointing error and corrects the antenna position accordingly. Author

N76-29331* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PERFORMANCE FLAT PLATE SOLAR COLLECTOR **c44**
F. L. Lansing and R. Reynolds *In its* The Deep Space Network 15 Aug. 1976 p 90-99 refs (For availability see N76-29318 20-12)
CSCL 10A

The potential use of porous construction is presented to achieve efficient heat removal from a power producing solid and is applied to solar air heaters. Analytical solutions are given for the temperature distribution within a gas-cooled porous flat plate having its surface exposed to the sun's energy. The extracted thermal energy is calculated for two different types of plate transparency. Results show the great improvement in performance obtained with porous flat plate collectors as compared with analogous nonporous types. Author

N76-29332* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN MBASIC APPLICATION PROGRAM FOR RELATIONAL INQUIRIES ON A DATA BASE **c61**
R. M. Smith *In its* The Deep Space Network 15 Aug. 1976 p 100-107 refs (For availability see N76-29318 20-12)
CSCL 09B

An MBASIC application program is described that allows a user to specify and use a sequence of relational operations on a relational data base for the purpose of making an inquiry or for the purpose of transferring data to a new file. Author

N76-29333* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODING (MCD) PERFORMANCE DUE TO SYSTEM LOSSES **c61**
L. Webster *In its* The Deep Space Network 15 Aug. 1976 p 108-118 refs (For availability see N76-29318 20-12)
CSCL 09B

A model for predicting the computational performance of a maximum likelihood convolutional decoder (MCD) operating in a noisy carrier reference environment is described. This model is used to develop a subroutine that will be utilized by the Telemetry Analysis Program to compute the MCD bit error rate. When this computational model is averaged over noisy reference phase errors using a high-rate interpolation scheme, the results are found to agree quite favorably with experimental measurements. Author

N76-29334* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT **c14**
E. B. Jackson *In its* The Deep Space Network 15 Aug. 1976 p 119-123 ref (For availability see N76-29318 20-12)
CSCL 22D

The activities of the Venus Station (DSS 13) and the Microwave Test Facility (MTF) during the period April 19 through June 13, 1976, are discussed and progress noted. Continuing reliability testing and computer program refinement of the remote controlled, unattended automated pulsar observing station is noted, along with routine observations of 17 pulsars. Radar observations of a geostationary satellite are reported, along with the routine automatic testing of the stability of the DSS 13 maser-receiving system. Additional testing of thermal characteristics of semiflexible coaxial cables is reported, along with phase stabilization measurements thereon. Routine support of the planetary radio astronomy experiment, with 43.25 hours of observations of Jupiter and various radio calibration sources, is reported, along with 18.75 hours of differential VLBI observations in conjunction with Australia, DSS 43. Modifications of the clock synchronization winterization system are reported, along with a discussion of the activities of the DSN High-Power Transmitter Maintenance Facility. Author

N76-29335* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF LOAD AND GO COUNTDOWNS BY THE DSN DEEP SPACE STATIONS **c14**
J. T. Hatch *In its* The Deep Space Network 15 Aug. 1976 p 124-128 (For availability see N76-29318 20-12)
CSCL 22D

The Level-4 Prepass Readiness Test (PRT) (the load and go countdown) provides an effective and low risk method of improving network productivity. A carefully controlled trial period preceded the full-scale application of the Level-4 PRTS to Pioneer, Helios, and Viking cruise tracking operations. Use of this load and go concept to count down a station brings about a substantial increase in the proportion of total station hours devoted to spacecraft tracking. Author

N76-29336* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASPECTS OF JOB SCHEDULING **c81**
K. Phillips *In its* The Deep Space Network 15 Aug. 1976 p 129-140 refs (For availability see N76-29318 20-12)
CSCL 05A

A mathematical model for job scheduling in a specified context is presented. The model uses both linear programming and combinatorial methods. While designed with a view toward optimization of scheduling of facility and plant operations at the Deep Space Communications Complex, the context is sufficiently general to be widely applicable. The general scheduling problem including options for scheduling objectives is discussed and fundamental parameters identified. Mathematical algorithms for partitioning problems germane to scheduling are presented. Author

N76-29337* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMIC MODELING FOR EVALUATION OF SOLAR COLLECTOR PERFORMANCE **c44**
C. L. Hamilton *In its* The Deep Space Network 15 Aug. 1976 p 141-146 refs (For availability see N76-29318 20-12)
CSCL 10A

Dynamic modeling is being developed to provide a tool for systematic analysis of performance characteristics in energy systems where time-dependent behavior is important. A dynamic model program designed to aid in the understanding of solar collector behavior over the full range of operating conditions was constructed and tested in the evaluation of a conceptual collector design. Author

N76-29338* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TOWARD A MATHEMATICAL MODEL OF SOLAR RADIATION FOR ENGINEERING ANALYSIS OF SOLAR ENERGY SYSTEMS **c44**
C. L. Hamilton and M. S. Reid *In its* The Deep Space Network 15 Aug. 1976 p 147-151 refs (For availability see N76-29318 20-12)
CSCL 10A

The currently most-used insolation model and what improvements might be made in it to better suit it for use in designing energy systems is discussed. An approach to constructing an upgraded model is sketched. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-29339*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION USERS' GUIDE
H. Chang and J. M. Williams May 1976 50 p
(Contract NAS9-12200)
(NASA-CR-147836; LEC-8181; JSC-11023) Avail: NTIS HC $4.00 CSCL 22A

The scheduling algorithm for mission planning and logistics evaluation (SAMPLE) program is a mission planning tool composed of three subsystems; the mission payloads subsystem (MPLS), which generates a list of feasible combinations from a payload model for a given calendar year; GREEDY, which is a heuristic model used to find the best traffic model; and the operations simulation and resources scheduling subsystem (OSARS), which determines traffic model feasibility for available resources. The SAMPLE provides the user with options to allow the execution of MPLS, GREEDY, GREEDY-OSARS, or MPLS-GREEDY-OSARS. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N76-29340*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STARSAT: A SPACE ASTRONOMY FACILITY
E. C. Hamilton, C. E. Mundie, D. Korsch, R. A. Love, F. S. Fuller, J. R. Parker, C. G. Fritz, R. E. White, and R. J. Giudici Jul. 1976 83 p refs
(NASA-TM-X-73326) Avail: NTIS HC $5.00 CSCL 14B

Preliminary design and analyses of a versatile telescope for Spacelab missions are presented. The system is an all-reflective Korsch three-mirror telescope with excellent performance characteristics over a wide field and a broad spectral range, making it particularly suited for ultraviolet observations. The system concept is evolved around the utilization of existing hardware and designs which were developed for other astronomy space projects. Author

N76-29341# Human Resources Research Organization, Alexandria, Va.
ASSEMBLY AREA TROUBLE SHOOTING MANUAL: MISSILE GUIDANCE SET AN/DPW-11. GUIDED MISSILE TEST SET AN/DSM-12. GUIDED MISSILE ELECTRICAL TEST SET M22. NIKE-AJAX ANTIAIRCRAFT GUIDED MISSILE SYSTEM **Research Product**
Mar. 1962 374 p
(Contract DA-44-188-ARO-2)
(AD-A020701) Avail: NTIS CSCL 16/1

The experimental manual presents illustrations, troubleshooting instructions and schematic diagrams for the NIKE-AJAX Antiaircraft Guided Missile System. Color illustrations are reproduced in black and white. GRA

N76-29319* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1976 p 1-3 (For availability see N76-29318 20-12)
CSCL 22D

N76-29320* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Aug. 1976 p 4-20 (For availability see N76-29318 20-12)
CSCL 22D

N76-29321* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. G. Meeks, and R. E. Morris *In its* The Deep Space Network 15 Aug. 1976 p 21-32 refs (For availability see N76-29318 20-12)
CSCL 22D

N76-29334* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Aug. 1976 p 119-123 ref (For availability see N76-29318 20-12)
CSCL 22D

N76-29335* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF LOAD AND GO COUNTDOWNS BY THE DSN DEEP SPACE STATIONS
J. T. Hatch *In its* The Deep Space Network 15 Aug. 1976 p 124-128 (For availability see N76-29318 20-12)
CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-29342*# Ohio State Univ. Research Foundation, Columbus.
BASIC RESEARCH AND DATA ANALYSIS FOR THE NATIONAL GEODETIC SATELLITE PROGRAM Final Report
Ivan I. Mueller Jul. 1976 12 p refs
(Grant NGL-36-008-093; OSURF Proj. 2514)
(NASA-CR-148564; Rept-241) Avail: NTIS HC $3.50 CSCL 05B

Reports and papers dealing with data analysis for the National Geodetic Satellite Program by Ohio State University's Department of Geodetic Science are listed. J.M.S.

N76-29343*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PURGING OF MULTILAYER INSULATION BY GAS DIFFUSION
Irving E. Sumner and Charles M. Spuckler Washington Aug. 1976 53 p refs
(NASA-TN-D-8122) Avail: NTIS HC $4.50 CSCL 21I

An experimental investigation was conducted to determine the time required to purge a multilayer insulation (MLI) panel with gaseous helium by means of gas diffusion to obtain a condensable (nitrogen) gas concentration of less than 1 percent within the panel. Two flat, rectangular MLI panel configurations, one incorporating a butt joint, were tested. The insulation panels consisted of 15 double-aluminized Mylar radiation shields separated by double silk net spacers. The test results indicated that the rate which the condensable gas concentration at the edge or at the butt joint of an MLI panel was reduced was a significant factor in the total time required to reduce the condensable gas concentration within the panel to less than 1 percent. The experimental data agreed well with analytical predictions made by using a simple, one-dimensional gas diffusion model in which the boundary conditions at the edge of the MLI panel were time dependent. Author

N76-29344*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB LESSONS LEARNED AS APPLICABLE TO A LARGE SPACE STATION, 1967-1974 Ph.D. Thesis - Catholic Univ. of Am.
William C. Schneider Apr. 1976 286 p refs
(NASA-TM-X-73073) Avail: NTIS HC $9.25 CSCL 22B

This report records some of the lessons learned during Skylab development. The approach taken is to list lessons which could have wide application in the development of a large space station. The lessons are amplified and explained in light of the background and experiences of the Skylab development. Author

N76-29345*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/GODDARD SPACE FLIGHT CENTER (GSFC) SOUNDING-ROCKET PROGRAM
John G. Guidotti Jun. 1976 45 p refs
(NASA-TM-X-71162; X-740-76-144) Avail: NTIS HC $4.00 CSCL 19G

An overall introduction to the NASA sounding rocket program as managed by the Goddard Space Flight Center is presented. The various sounding rockets, auxiliary systems (telemetry, guidance, etc.), launch sites, and services which NASA can provide are briefly described. Author

N76-29346# European Space Agency, Paris (France).
THE POTENTIAL OF SPACELAB FOR SPACE APPLICATIONS MISSIONS AND THE ORGANISATION FOR ITS USE
A. Lebeau, D. J. Shapland, and J. Collet 1975 31 p ref
Presented at the 6th US/European Eurospace Conf., Monte Carlo, 13-16 Oct. 1975
Avail: NTIS HC $4.00

A broad background of Spacelab capabilities in the areas of applications missions is provided and potential payloads are discussed. ESA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-29347* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACCELEROMETER TELEMETRY SYSTEM Patent
Eph Konigsberg, inventor (to NASA) (Konigsberg Instr., Inc.) Issued 27 Jul. 1976 8 p Filed 28 Mar. 1975 Supersedes N75-20685 (13 - 12, p 1387) Sponsored by NASA
(NASA-Case-ARC-10849-1; US-Patent-3,972,038; US-Patent-Appl-SN-563049; US-Patent-Class-340-189M;

US-Patent-Class-73-493; US-Patent-Class-73-517R; US-Patent-Class-340-206) Avail: US Patent Office CSCL 17B

An accelerometer telemetry system incorporated in a finger ring is used for monitoring the motor responses of a subject. The system includes an accelerometer, battery, and transmitter and provides information to a remote receiver regarding hand movements of a subject wearing the ring, without the constraints of wires. Possible applications include the detection of fatigue from the hand movements of the wearer.

Official Gazette of the U.S. Patent Office

N76-29348*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.

SHUTTLE ONBOARD IMU ALIGNMENT METHODS

D. M. Henderson 23 Jul. 1976 26 p refs

(Contract NAS9-14960)

(NASA-CR-147848; E914-8A/B-005) Avail: NTIS HC $4.00 CSCL 22A

The current approach to the shuttle IMU alignment is based solely on the Apollo Deterministic Method. This method is simple, fast, reliable and provides an accurate estimate for the present cluster to mean of 1,950 transformation matrix. If four or more star sightings are available, the application of least squares analysis can be utilized. The least squares method offers the next level of sophistication to the IMU alignment solution. The least squares method studied shows that a more accurate estimate for the misalignment angles is computed, and the IMU drift rates are a free by-product of the analysis. Core storage requirements are considerably more; estimated 20 to 30 times the core required for the Apollo Deterministic Method. The least squares method offers an intermediate solution utilizing as much data that is available without a complete statistical analysis as in Kalman filtering. Author

N76-29349*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.

STAR TRACKER CONSTRAINT VIOLATIONS DIGITAL CAPABILITY DESCRIPTION AND ANALYSIS RESULTS. MISSION PLANNING, MISSION ANALYSIS, AND SOFTWARE FORMULATION

P. L. Poston 30 Jan. 1975 32 p refs

(NASA-CR-147847; Note-1-4-2-7) Avail: NTIS HC $4.00 CSCL 22B

Results of star tracker constraint violation analyses performed with the digital computer program Shuttle Attitude and Pointing Time Line Proccessor (SAPT) are presented. Results are typical of those utilized to provide the information required to update Baseline Reference Mission Attitude and Pointing Time Lines. Descriptions of SAPT modifications implemented to perform these analyses are also presented. Author

N76-29350# Naval Ship Research and Development Center, Bethesda, Md.

MULTI-CHANNEL PRESSURE TELEMETRY SYSTEM FOR BASE PRESSURE MEASUREMENTS ON SMALL MODELS Final Report

George S. Pick and Samuel E. Dawson Jul. 1975 24 p refs Repr. from the Proceedings of the Intern. Cong. on Instrumentation in Aerospace Simulation Facilities, New York, 4-8 May 1969 (WR0090201)

(AD-A022334; Aero-1212; DTNSRDC-4698) Avail: NTIS CSCL 09/6

Effects of close proximity on simultaneously operating transducer-telemetry units had been systematically evaluated. Parameters such as the interaction as function of transducer-to-transducer distances, center frequency spread and its effect on the interaction, change of sensitivity in relation to center frequency, center frequency shifts as functions of transducer-to-transducer distances, and the effects of common power supply and shielding have been evaluated. The results showed that the interaction increases approximately as the inverse square of the distance. The center frequency spread has the most significant effect on the interaction. If 7MHZ or larger frequency spacing is maintained the maximum error is plus or minus 8 percent for the pressure range of 0.5 to 2.0 mm Hg. The measured data can be corrected by an interaction matrix method and yield errors in the order of a few percent depending on the accuracy of calibration. GRA

N76-29351# Air Force Weapons Lab., Kirtland AFB, N.Mex.

SATELLITE COMMUNICATIONS IN A SCINTILLATED ENVIRONMENT Final Report

Leon A. Wittwer Jan. 1976 63 p refs

(AF Proj. 4695)

(AD-A021091; AFWL-TR-75-240) Avail: NTIS CSCL 17/2

An improved method of calculating the statistical properties of a signal propagating through a strongly striated ionosphere is described. Calculations are carried out for a representative equatorial and polar ionosphere. The results are then used to evaluate the performance of an M-ary frequency shift key and a binary phase shift key satellite communications link.

Author (GRA)

N76-29352# Lincoln Lab., Mass. Inst. of Tech., Lexington.

RADIATION PATTERN CALCULATIONS FOR A WAVEGUIDE LENS MULTIPLE-BEAM ANTENNA OPERATING IN THE AJ MODE

Bing M. Potts 14 Oct. 1975 69 p refs

(Contract F19628-76-C-0002)

(AD-A020167; TN-1965-25; ESD-TR-75-299) Avail: NTIS CSCL 17/4

The jammer suppression obtained with a multiple-beam antenna (MBA) by radiation pattern shaping is studied for applications with the DSCS 3 satellites. Results are presented for three separate MBA designs each consisting of an X-band waveguide lens excited by a multi-element feed cluster located in its focal plane. To demonstrate the AJ performance of each MBA, calculations were carried out for a large number of jammer locations distributed over the surface of the earth. At each location, the jammer suppression is achieved by adjusting the amplitude excitation of the feed elements to create an earth-coverage radiation pattern with a minimum located in the direction of the jammer. Results which characterize the AJ performance of each MBA in terms of the null level at the jammer, null coverage area and frequency dependence are presented.

Author (GRA)

N76-29353# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

CIRCUIT STATUS OF MULTIPLE-SATELLITE-HOP USER REACTION TESTS

Donald V. Glen, Earl C. Bolton, James C. Blair, and Peter M. McManamon Jan. 1976 219 p refs Sponsored in part by FCC

(PB-251561/7; OT-SP-76-8) Avail: NTIS HC $7.75 CSCL 17B

These user reaction tests involved voice telephone communications that were relayed one, two, or three times through the Westar satellite. Subjective and objective measurements of circuit quality were made. Author (GRA)

N76-29354# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

SPIN MODULATION STATISTICS OF THE GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES) DATA COLLECTION SYSTEM

Donald V. Glen and Martin J. Miles Feb. 1976 41 p refs

(PB-251638/3; OTR-76-81) Avail: NTIS HC $4.00 CSCL 17B

The results are presented of statistical analyses of the interrogation and data reply carrier signals transmitted through a Geostationary Operational Environmental Satellite (GOES) between a Data Collection Platform Radio Set (DCPRS) and the Command and Data Acquisition (CDA) station. Statistical parameters included are the mean and standard deviation of the signals, the computer plots of (a) data during one revolution of the spacecraft, (b) mean values from 1,000 revolutions of the spacecraft, (c) the differences between the sample and the mean values and (d) the mean values for 1,000 differences. These parameters have been determined for the output of the Data Collection Platform Interrogate (DCPI) phase detector, the output of the Data Collection Platform Reply (DCPR) phase detector, and the DCPR amplitude ripple. GRA

N76-29322* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMPUTATION OF SPACECRAFT SIGNAL RAYPATH TRAJECTORIES RELATIVE TO THE SUN

A. R. Cannon and C. T. Stelzried *In its* The Deep Space Network 15 Aug. 1976 p 33-38 ref (For availability see N76-29318 20-12)
CSCL 20N

N76-29323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELECOMMUNICATIONS DIVISION FOURTH HARMONIC POWER ANALYZER
C. Foster *In its* The Deep Space Network 15 Aug. 1976 p 39-46 refs (For availability see N76-29318 20-12)
CSCL 09C

N76-29327* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING TELECOMMUNICATION EFFECTS OF GEOS SATELLITE INTERFERENCE BASED ON TESTING AT THE MADRID DEEP SPACE STATION
F. V. Stuhr, S. S. Kent, J. L. Galvez, B. G. Luaces, G. R. Pasero, and J. M. Urech *In its* The Deep Space Network 15 Aug. 1976 p 60-74 ref (For availability see N76-29318 20-12)
CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-29355*# Chrysler Corp., New Orleans, La. Space Div.
SHUTTLE MODEL TAILCONE PRESSURE DISTRIBUTION AT LOW SUBSONIC SPEEDS OF A 0.03614-SCALE MODEL IN THE NASA/LaRC LOW-TURBULENCE PRESSURE TUNNEL (LA81), VOLUME 1
J. W. Ball and R. H. Lindahl Jun. 1976 775 p 2 Vol.
(Contract NAS9-13247)
(NASA-CR-147609; DMS-DR-2296-Vol-1) Avail: NTIS HC $18.75 CSCL 22B

An investigation was conducted in the NASA/LaRC Low-Turbulence Pressure Tunnel on a 0.03614-scale orbiter model of a 089B configuration with a 139B configuration nose forward of F.S. 500. The tailcone was the TC sub 4 design and was instrumented with eighty-nine pressure orifices. Control surfaces were deflected and three wind tunnel mounting techniques were investigated over an angle-of-attack range from -2 deg to a maximum of 18 deg. In order to determine the sensitivity of the tailcone to changes in Reynolds number, most of the test was made at a Mach number of 0.20 over a Reynolds number range of 2.0 to 10 million per foot. A few runs were made at a Mach number of 0.30 at Reynolds numbers of 4.0, 6.0, and 8 million per foot. Author

N76-29356*# Chrysler Corp., New Orleans, La. Space Div.
SHUTTLE MODEL TAILCONE PRESSURE DISTRIBUTION AT LOW SUBSONIC SPEEDS OF A 0.03614-SCALE MODEL IN THE NASA/LaRC LOW-TURBULENCE PRESSURE TUNNEL (LA81), VOLUME 2
J. W. Ball and R. H. Lindahl Jun. 1976 393 p 2 Vol.
(Contract NAS9-13247)
(NASA-CR-147610; DMS-DR-2296-Vol-2) Avail: NTIS HC $10.75 CSCL 22B
For abstract, see Vol 1.

N76-29357# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE SHOCK-ABSORPTION OF DOCKED SPACECRAFT AFTER COUPLING
V. S. Syromiatnikov [1976] 11 p Transl. into ENGLISH from Kosmich. Issled. (USSR), no. 2, vol. 14, 1976 p 220-229
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The shock absorption of two spacecraft during docking after coupling is considered as the collision of two solids with linear and angular shock absorbers at a common point. The problem reduces to just a study of the strain equations of the shock-absorbers themselves. The plane case is considered in detail, and the singularities for different combinations of the craft parameters and the docking mechanisms are analyzed. Author

N76-29358*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NESTABLE TAPERED COLUMN CONCEPT FOR LARGE SPACE STRUCTURES
Harold G. Bush and Martin M. Mikulas, Jr. Jul. 1976 18 p refs
(NASA-TM-X-73927) Avail: NTIS HC $3.50 CSCL 22B

A structural element concept is described which permits achievement of weight critical payloads for space shuttle. These columns are highly efficient structural members which could be the basic building elements for very large, space truss structures. Parametric results are presented which show that untapered cylindrical columns result in volume limited payloads on the space shuttle and that nestable, tapered columns easily eliminate this problem. It is recognized that the tapered column concept belongs to a class of structures which must be assembled in orbit. However, analytical results are presented which indicate that the gain in the amount of structure placed in orbit per launch, is great enough that such a concept should be considered in future systems studies of very large space structures. Author

N76-29359# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
FINITE DIFFERENCE SCHEMES FOR THE SOLUTION OF THE NOSETIP SHAPE CHANGE EQUATIONS Final Report, Jan. - Jul. 1975
P. G. Crowell 30 Sep. 1975 61 p refs
(Contract F04701-75-C-0076)
(AD-A020666; TR-0076(6550-15)-1; SAMSO-TR-76-8) Avail: NTIS CSCL 16/2

A number of finite difference schemes have been used to solve the nosetip shape change equation for the same surface recession model. The physical description of the surface recession rate (i.e, S) has been made as realistic as possible and includes most of the effects known to influence the shape change process. In particular, two different assumptions concerning the boundary layer edge entropy have been used to obtain both 'smooth' and 'rough' S distributions. Both explicit and implicit first and second order accurate schemes were considered. Naturally dissipative schemes and implicit schemes with the addition of a viscous damping term are examined. Stability limits are obtained from a linearized stability analysis and examined numerically. A number of computationally difficult cases, involving high recession rates and large surface curvature, have been used to evaluate the various difference schemes. The results indicate that the 'standard' forward time-central space explicit scheme is inherently unstable and should not be used for the shape change equation. The sensitivity of the S model to small changes in surface shape is shown to exhibit a strong influence on the accuracy of the difference schemes. The implicit schemes are shown to be superior, particularly for 'rought' S distributions, and are recommended for use in nosetip shape change codes. GRA

N76-29360# Physical Sciences, Inc., Wakefield, Mass.
ADVANCED REENTRY AEROMECHANICS. VOLUME 3: LASER SIMULATION OF EROSION Interim Scientific Report, 1 Jul. 1974 - 30 Jun. 1975
P. E. Nebolsine 31 Aug. 1975 48 p refs
(Contract F44620-74-C-0022; AF Proj. 9781)
(AD-A020748; PSI-TR-29-Vol-3; AFOSR-76-0059TR-Vol-3) Avail: NTIS CSCL 16/3

Experiments using a pulsed laser to simulate hypervelocity impact during erosion are discussed in this report. The impact pressures of hundreds of kilobars and impulses found in hypervelocity impact can be generated in a target under a vacuum when irradiated with a laser. A model is discussed which relates the laser parameters to equivalent particle parameters. The experiments were performed using a one joule Q-switched ruby laser. The laser system quantitatively simulated erosion of cloud size particles, particle diameters to 100 micrometers. Brittle and ductile materials were tested during the program. The experimental results show that for ATJ-S graphite, the crater mass loss scales approximately as kinetic energy of the equivalent particle (1/2m

V to the 1.93 + or - 0.16 power according to a least squares fit). It was also observed that the crater mass loss for predamaged materials was enhanced by approximately 50% over virgin material mass loss. The tests were conducted over an equivalent water particle velocity of from 2.5 to 18 km/sec. Crater Mass loss ratio measurements were compared to glass particle impact data. The average laser produced crater mass loss ratio was within the scatter of single glass bead particle data.
Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-29361*# Ball Bros. Research Corp., Boulder, Colo.
EXTREME SOLAR ULTRAVIOLET MONITOR (ESUM) FOR ATMOSPHERE EXPLORER
1 Apr. 1976 59 p refs
(Contract NAS5-11441)
(NASA-CR-144766; F76-10) Avail: NTIS HC $4.50 CSCL 14B

The design, operation, and calibration of both ESUM-C and ESUM-E are discussed along with objectives, system design, and function. Author

N76-29362# Emmanuel Coll., Boston, Mass.
DESIGN OF A LOW ENERGY PROTON SPECTROMETER Final Report, 1 Nov. 1970 - 31 Oct. 1975
J. Pantazis, Alan Huber, and Patricia M. Hagan Dec. 1975 30 p refs
(Contract F19628-71-C-0060; AF Proj. 8600)
(AD-A021469; AFCRL-TR-75-0637) Avail: NTIS CSCL 18/4

An instrument was designed to detect and analyze protons of energy between 100 keV and 6 MeV. Two totally depleted surface barrier detectors are used in an anticoincidence mode. Electronic logic (anti-coincidence) allows pulse height analysis only of a pulse from the first detector which is unaccompanied by a pulse from the second. The front detector is specially made with an extra thick film of aluminum coating in order to permit operation with the sun in the field of view. Sweeping magnets discriminate against electrons that might give erroneous pulses. A micro C Am 241 radioactive source is mounted on a rotary solenoid which swings into view automatically to put the instrument into a calibration made at preset intervals. Five instruments were made to be flown on satellites and one for back-up. One instrument has just flown on S3-2 satellite, two to be flown on S3-3 and two more on SOLRAD-HI A and B satellites. GRA

N76-29363# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
FLIGHT TEST PREPARATION OF THE ELECTRICALLY SUSPENDED ACCELEROMETER, PHASE 3-A Final Report, Apr. 30 - Sep. 1975
Donald F. Elwell and Barry K. Likeness 20 Feb. 1976 118 p
(Contract F04701-75-C-0160)
(AD-A021727; SAMSO-TR-75-230) Avail: NTIS CSCL 22/2

The GG1012AB01 Electrically Suspended Accelerometer (ESA) is a three-axis accelerometer designed for space applications. The dynamic range of this instrument covers four decades and can be set anywhere in the 0.002 to 10 to the -11g range. The instrument has potential application to spacecraft navigation in the presence of atmospheric drag, solar pressure, magnetic and electric fields, and other external disturbances which produce accelerations of this magnitude. This document summarizes the progress on the program made during the period of April 1975 through September 1975. The ESA was modified, calibrated and recalibrated. Calibration data was collected with the ESA mounted in a flotation chamber which provides the means of controlling static forces in the range of .01 to .0000001g as test input to the accelerometer. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N76-29364*# TRW, Inc., Redondo Beach, Calif. Systems Engineering and Analysis Dept.
UTILIZATION OF SOLID-PROPELLANT UPPER STAGES IN STS PAYLOAD ORBITAL OPERATIONS
S. W. Wilson 24 Jun. 1976 76 p refs
(Contract NAS9-14723)
(NASA-CR-147828; TRW-28415-H002-RO-00) Avail: NTIS HC $5.00 CSCL 21H

The main purpose of this report is to discuss techniques of trajectory design, maneuver execution, and stage loading that are compatible with the use of SRM's (solid rocket motors) which, once ignited, must burn to propellant depletion. It is anticipated that some shuttle payloads will use non-IUS (interim upper stage) solid propellant kick stages; therefore this subject is also pertinent to shuttle flights other than those involving the use of the IUS. The SRM utilization techniques can be divided into two major categories: (1) those in which the stage performance is adjusted to match the velocity increment magnitude requirements of a preselected trajectory, and (2) those in which the trajectory is designed to match the velocity increment magnitude capability of the stage(s). Author

N76-29365*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOLDED COMPOSITE PYROGEN IGNITER FOR ROCKET MOTORS Patent Application
Melvin H. Lucy and Wilbur C. Heier, inventors (to NASA) Filed 20 Apr. 1976 26 p
(NASA-Case-LAR-12018-1; US-Patent-Appl-SN-678520) Avail: NTIS HC $4.00 CSCL 21H

A molded plastics composite rocket motor pyrogen igniter assembly that may be produced on a production line basis is described. The igniter assembly is readily adaptable for all existing and anticipated rocket motors that may be employed by NASA for sounding rocket vehicles and in various military rocket motors as well as space shuttle payload rocket launches. NASA

N76-29366# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
QUALIFICATION OF A NEW MAPO SOURCE AND ERL-510 CURING AGENT FOR MINUTEMAN STAGE 1 UF-2121 LINER Semiannual Report
John A. Thompson Mar. 1976 15 p
(AD-A022323; MANCP-339(76)) Avail: NTIS CSCL 19/7

Thiokol Chemical Corporation/Wasatch Division used MAPO in the production of UF-2121 liner. Thiokol changed MAPO vendors, and, therefore, qualification of the new source MAPO was required. Thiokol prepared specimens from the new source and also specimens from the original source which were used as the control material in the qualification testing. The specimens were transferred to Ogden ALC for testing and reporting of the data obtained. This report includes the test results for the first time testing of the control and special specimens at Ogden ALC. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-29367*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EQUIVALENT ENERGY FOR THE OUTGASSING OF SPACE MATERIALS

John J. Scialdone Washington Aug. 1976 14 p refs
(NASA-TN-D-8294; G-7693) Avail: NTIS HC $3.50 CSCL 07D

Materials for space applications must have low outgassing rates at normal operating temperatures, and the outgassing products should include a minimum of condensables at the temperatures of nearby surfaces. A screening method, developed several years ago and used at many space laboratories, consists of holding a material sample at 398 K (125 C) for 24 hours and measuring its percentage total mass loss (TML) and the percentage volatile condensable mass (VCM) accreted on a 298-K (25-C) collector. In general, the material is acceptable if the TML is less than 1 percent and the VCM is less than 0.1 percent. An analysis of the test and its results is presented. Author

N76-29368# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
UREA PROCESS ANALYTICAL STUDY Final Report, Oct. - Dec. 1975
Louis A. Dee and Steven G. Wax Mar. 1976 17 p
(AD-A021936; AFRPL-TR-76-16) Avail: NTIS CSCL 07/3

In an effort to help determine the feasibility of the Urea process for production of the amine fuels, AFRPL established an in-house program to develop a useful analytical technique for monitoring the critical DMU to UDMH reaction. It was the absence of such a technique that presented problems for Vicksburg Chemical Company during their production contract with AFLC. Using laboratory scale equipment, AFRPL produced UDMH using purified DMU. Analysis of both reaction mixture and distillate was accomplished during all of the synthesis runs. After a variety of attempts, it was concluded that analysis of the DMU to UDMH reaction is difficult and propably not useful. Thus, great care must be taken in the scale up of the Urea process. GRA

N76-29369# Naval Air Development Center, Warminster, Pa.
THE CHEMISTRY AND APPLICATIONS FOR THE SOLUBILIZATION OF CHROMATE SALTS IN NONPOLAR ORGANIC MEDIA, PART 2 Final Report
J. Ohr and Kenneth G. Clark 23 Dec. 1975 16 p refs
(ZF61412001)
(AD-A021534; NADC-75308-30) Avail: NTIS CSCL 07/3

The hexavalent anionic partner to the dibenzo-18-crown-6 and 18-crown-6 complexes made according to U.S. Patent Application Serial No. 511328 (Allowed) by Ohr and Clark was determined to be Chlorochromate, CrO3Cl(-). The complexes when dissolved in small amounts in paint coatings provide good corrosion protection to aircraft metals such as aluminum, steel, and magnesium; but are impractical for Fleet use at this time because of their poor storage stability properties. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-29370*# General Electric Co., Schenectady, N.Y. Metallurgy Lab.
COATINGS FOR DIRECTIONAL EUTECTICS Final Report
J. R. Rairden and M. R. Jackson 25 Jul. 1976 82 p refs
(Contract NAS3-17815)
(NASA-CR-135050; SRD-76-076) Avail: NTIS HC $5.00 CSCL 11D

Significant advances have been made in the development of an environmentally stable coating for a very high strength, directionally solidified eutectic alloy designated NiTaC-13. Three duplex (two-layer) coatings survived 3,000 hours on a cyclic oxidation test (1,100 C to 90 C). These coatings were fabricated by first depositing a layer of NiCrAl(Y) by vacuum evaporation from an electron beam heated source, followed by depositing an aluminizing overlayer. The alloy after exposure with these coatings was denuded of carbide fibers at the substrate/coating interface. It was demonstrated that TaC fiber denudation can be greatly retarded by applying a carbon-bearing coating. The coating was applied by thermal spraying followed by aluminization. Specimens coated with NiCrAlCY+Al survived over 2,000 hours in the cyclic oxidation test with essentially no TaC denudation. Coating ductility was studied for coated and heat-treated bars, and stress rupture life at 871 C and 1,100 C was determined for coated and cycled bars. Author

N76-29371*# Scientific Translation Service, Santa Barbara, Calif.
RPE STUDY OF PREGRAPHITIC CARBONS INFLUENCE OF INTERSTITIAL CARBON ATOMS
H. Estrade-Szwarckopf, J. Conard, and J. Mering Washington NASA Aug. 1976 15 p refs Transl. into ENGLISH from Carbon (England), v. 13, 1975 p 11-16
(Contract NASw-2791)
(NASA-TT-F-17195) Avail: NTIS HC $3.50 CSCL 11D

A relationship is shown between electronic properties of pregraphitic carbons and the concentration of interstitial atoms of carbon observed by structural X-ray studies. (E.P.R.) measurements were performed on two series of carbons, respectively characterized by a very low (2%) and a very high (8%) concentration of interstitial atoms. The results are interpreted, taking into account the presence of interstitial atoms. Author

N76-29372# Naval Research Lab., Washington, D.C.
HIGH PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT Progress Report, 1 Jul. - 31 Dec. 1975
Willard D. Bascom and Luther B. Lockhart, Jr. Feb. 1976 58 p refs
(Contracts NRL-Proj. C04-10; SF54903201)
(AD-A022331; NRL-MR-3223) Avail: NTIS CSCL 11/4

An interdisciplinary program has been undertaken to addresss the composite and adhesive materials requirements of V/STOL aircraft. The primary tasks are to develop and characterize high-temperature and high-toughness resins, fabricate graphite-fiber reinforced composites, develop composite failure criteria for design optimization and establish quality control parameters. GRA

N76-29373# Construction Engineering Research Lab., Champaign, Ill.
BONDING BETWEEN CEMENT HYDRATES AND STEEL Final Report Ph.D. Thesis
G. D. Schnittgrund and J. K. Scott Jan. 1976 57 p refs
(DA Proj. 4A1-62121-A-897)
(AD-A021651; CERL-Technical-MS-M-176) Avail: NTIS CSCL 13/2

The bonding mechanics of steel to portland cement and its constituent compounds were studied by testing composite steel/paste bars in flexure. The interface was subsequently examined by scanning electron microscopy. Type I portland cement, tricalcium silicate, dicalcium silicate, and tetracalcium aluminoferrite exhibited strong bonding to low carbon steel; tricalcium aluminate demonstrated no measurable bond strength. The primary bonding mechanism between alite paste and steel was found to be chemical in nature. No significant influence of the surface roughness of the steel on the tensile bond strength to alite paste could be established. The weak link in the steel/paste bar was a high water content region concentrated near the steel/paste interface. Author (GRA)

N76-29374# Auburn Univ., Ala. Engineering Experiment Station.
FLAW DETECTION IN THIN COMPOSITE MATERIAL STRUCTURES WITH HOLOGRAPHIC TECHNIQUES Final Report, 1 Apr. 1974 - 30 Jun. 1975
V. R. Kinariwala, W. F. Ranson, and W. F. Swinson Feb. 1976 90 p refs
(Contract DAAH01-74-C-0600)
(AD-A021942; ME-AMC-0600) Avail: NTIS CSCL 11/4

Holographic interferometry was used as a non-destructive testing method to measure the surface deformation of subsurface flaws in filament wound composite cylinders. Three cylinders with different flaw geometries were tested to determine the effect of flaws in the interferometric fringe patterns. The flaw geometries were a circular flaw one-half inch in diameter, a flaw around the circumference of the cylinder one-half inch wide and a flaw one-half inch wide parallel to the longitudinal axis of the cylinder. Equations were developed which would predict the radial surface displacement component of each cylinder. The results were presented in graphical form. GRA

N76-29375# General Electric Co., Schenectady, N.Y.
RESEARCH WITH IN-SITU COMPOSITES ALIGNED WITH EUTECTOID AND EUTECTIC TRANSFORMATIONS Final Report, 1 May 1973 - 1 May 1975
J. G. Smeggil Aug. 1975 160 p refs
(Contract F33615-73-C-5083; AF Proj. 7353)
(AD-A021530; SRD-75-095; AFML-TR-75-133) Avail: NTIS CSCL 11/4

Directionally aligned eutectoids are of potential interest for high temperature turbine applications. The Hf-HfCr2 eutectoid was selected from several systems, to explore the potential of using solid-solid transformation to yield a suitable, aligned microstructure. A series of Ni-TaC alloys and a Ni(Cr)-Ni3Al-Ni3Nb alloy have been examined in oxidation. Numerous effects dependent on microstructures, chemistry, and oxidation temperature were observed. Chemical vapor deposition (CVD) techniques were used to deposit simple and complex layers of the elements Ni, Cr, and Al required for high temperature, oxidation resistant coatings. This work demonstrated the feasibility of depositing sequential layers. GRA

N76-29376# Materials Sciences Corp., Blue Bell, Pa.
INVESTIGATION OF FAILURE MECHANISMS IN FIBER COMPOSITE LAMINATES Final Report, Jun. 1974 - Jun. 1975
Philip V. McLaughlin, Jr., Shiao N. Huang, and B. Walter Rosen Jun. 1975 100 p refs
(Contract N62269-74-C-0662)
(AD-A021242; TFR/7508) Avail: NTIS CSCL 11/4

An analytical investigation is made into the behavior of fiber composite laminates after initial lamina failure has occurred in top (outside) layer. The analysis investigates the relative importance of delamination of the failed layer and of stress concentrations in the adjacent lamina to the ultimate failure mechanisms of laminates. A general interlaminar stress analysis is developed which takes into account interface nonlinear behavior and delamination effects. The analysis is specialized to a laminate whose top layer contains a long crack. Laminated plate theory is used in conjunction with the interlaminar stress analysis to analyze first and subsequent failure of graphite/epoxy (0/90), (plus or minus 45), and (0/plus or minus 45) laminates under several stress states. GRA

N76-29377# Naval Postgraduate School, Monterey, Calif.
STRESS CONCENTRATION IN GLASS-EPOXY COMPOSITE PLATES M.S. Thesis
Sakol Vudhivai Dec. 1975 70 p refs
(AD-A021869) Avail: NTIS CSCL 11/4

This thesis reports a study of the stress concentration caused by holes out of center in thin plates of finite width made of crossply fiberglass composites. The results are reported in the form of the stress concentration factor, Ktg, as a function of two nondimensional parameters, one representing the influence of the size of the holes and the other representing their eccentricity. Thus graphs plotted for Ktg may be used for thin plates with holes of different dimensions. Author (GRA)

N76-29378# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
TENSILE BEHAVIOR OF NICKEL-BASE COMPOSITE MATERIALS
S. J. Burden and A. Lawley Feb. 1976 31 p refs
(Contract N00014-76-C-0205)
(AD-A021501) Avail: NTIS CSCL 11/4

The tensile behavior of Ni-Mo and Nichrome-W filamentary composites (V sub f < or = 0.2) has been examined with particular reference to the effect of prolonged exposure at temperatures up to 1,473 K. Composites were tested above and below the DBTT of the wire reinforcement to give a direct comparison of ductile matrix-ductile fiber and ductile matrix-brittle fiber behavior. Data were analyzed in terms of micromechanical models of composite deformation. For ductile fiber reinforcement, the rule of mixtures analysis of composite tensile strength must allow for a reduction in V sub f due to interface reaction, and for a decrease in the fracture strain of the composite compared to the as-fabricated condition. With brittle reinforcement, following elevated temperature exposure, composite tensile strength was lower than that of the matrix material; fiber-matrix reaction induces notch sensitivity in the fibers and alters constituent properties such that the fiber content required for reinforcement is raised to a level above that existing in the nickel or nichrome matrix. The nature and extent of the interface-reaction products were characterized and the effectiveness of diffusion barrier coatings of Y2O3 appraised. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-29379* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF I-123 Patent
James W. Blue, inventor (to NASA) Issued 27 Jul. 1976 5 p Filed 12 Jul. 1973 Supersedes N73-28128 (11 - 19, p 2248) Continuation-in-part of US Patent Appl. SN-247434, filed 25 Apr. 1972
(NASA-Case-LEW-11390-3; US-Patent-3,971,697; US-Patent-Appl-SN-247434; US-Patent-Appl-SN-380046; US-Patent-Class-176-11; US-Patent-Class-176-16; US-Patent-Class-176-14; US-Patent-Class-250-400; US-Patent-Class-250-429; US-Patent-Class-250-492R) Avail: US Patent Office CSCL 07D

Bombarding a cesium heat pipe with high energy particles causes a spallation reaction which produces vapors of Xe-123 and contaminants. The contaminants are removed in a dry ice cold trap while the Xe-123 condenses in a liquid nitrogen trap where it decays. Official Gazette of the U.S. Patent Office

N76-29380*# Pennsylvania State Univ., University Park. Ionospheric Research Lab.
THE REACTION OF NH2 WITH NO2
R. K. M. Jayanty, R. Simonaitis, and Julian Heicklen Jul. 1976 21 p refs
(Grants NGL-39-009-003; NSF GA-42856)
(NASA-CR-148598; PSU-IRL-SCI-448) Avail: NTIS HC $3.50 CSCL 07D

Ammonia (NH3) was photolyzed at 213.9 nm in the presence of NO2 at 25 C in order to study the reactions of NH2 with NO2. The products included NO, with a quantum yield of 1.0. The other measured products of the reaction were N2 and N2O with respective quantum yields of 0.94 plus or minus 0.10 and > 0.3 in the presence of small amounts of He and 0.65 plus or minus 0.15 and > 0.13 in the presence of a large excess of He. The quantum yield for NO2 consumption was 6.0 plus or minus 2.0 in the absence of He. These results are explained in terms of various reactions. Author

N76-29381*# Combustion, Heat, and Mass Transfer Ltd., New Malden (England).
EFFECT OF GRAVITY ON METHANE-AIR COMBUSTION
S. Elghobashi, H. I. Rosten, J. E. Smith, D. B. Spalding, and D. G. Tatchell 22 Dec. 1974 70 p refs
(Contract NASw-2671; CHAM Proj. 950)
(NASA-CR-135077; Rept-950/1) Avail: NTIS HC $4.50 CSCL 21B

Analytical and numerical techniques dealing with the theoretical description of the influence of zero and reduced gravitational acceleration on diffusion flames, with a view to improving understanding of fires in space vehicles, were developed in support of experimental work performed in this area. This was done in order to confirm qualitative understanding of the process, to determine the quantitative accuracy of numerical predictions, and to establish a mathematical model of the process for subsequent use as a predictive and exploratory tool. The following results were accomplished: (1) derivation of differential equations and boundary conditions describing the system, (2) details of the computations, using a FORTRAN computer program, for calculating the flow and heat and mass transfer in

two dimensions (both steady and unsteady). It was shown that the experimental behavior can be reproduced with fair accuracy, provided that the time step is sufficiently short. Y.J.A.

N76-29382*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A HYBRID COMPUTER PROGRAM FOR RAPIDLY SOLVING FLOWING OR STATIC CHEMICAL KINETIC PROBLEMS INVOLVING MANY CHEMICAL SPECIES

Allen G. McLain and C. S. R. Rao (Old Dominion Univ.) Washington NASA Jul. 1976 102 p refs
(NASA-TM-X-3403; L-10768) Avail: NTIS HC $5.50 CSCL 07D

A hybrid chemical kinetic computer program was assembled which provides a rapid solution to problems involving flowing or static, chemically reacting, gas mixtures. The computer program uses existing subroutines for problem setup, initialization, and preliminary calculations and incorporates a stiff ordinary differential equation solution technique. A number of check cases were recomputed with the hybrid program and the results were almost identical to those previously obtained. The computational time saving was demonstrated with a propane-oxygen-argon shock tube combustion problem involving 31 chemical species and 64 reactions. Information is presented to enable potential users to prepare an input data deck for the calculation of a problem. Author

N76-29383# California Univ., Berkeley. Lawrence Berkeley Lab.

POLAR HYDROGEN SCATTERING FACTORS IN X-RAY DIFFRACTION ANALYSIS Ph.D. Thesis

A. J. Olson Nov. 1975 190 p refs
(Contract W-7405-eng-48)
(LBL-4530) Avail: NTIS HC $8.50

The feasibility of applying a polar model of bonded hydrogen electron density to X-ray diffraction analysis is demonstrated. The modifications needed to accommodate the associated complex scattering factors in the least squares calculation are described and are shown to be readily incorporated into the standard crystallographic structure refinement program. Polar hydrogen scattering factors developed from the H2 molecule are applied to X-ray data from decaborane (B10H14)and sucrose (C12H22O22). This application has yielded improvements over the spherical hydrogen model in the derived B-H, C-H, and O-H bond lengths as judged by comparison to the corresponding distances determined by neutron diffraction studies of the same molecules. The improvements have not been uniform among the different bonding types. Using this polar hydrogen model in X-ray refinements, mean deviations from the neutron bond lengths for B-H, C-H, and O-H are 0.019A, 0.043A, and 0.079A respectively. ERA

N76-29384# Commission of the European Communities, Ispra (Italy). Joint Research Centre.

USE OF A SINGLE TECHNIQUE FOR THE SEPARATION AND DETERMINATION OF ACTINIDES IN BIOLOGICAL MATERIALS

V. Camera and M. Giubileo 1975 40 p refs In ITALIAN
(EUR-5407i) Avail: ERDA Depository Libraries HC $4.00

For the radiotoxicological survey of workers exposed to different types of alpha-emitting contaminants, a procedure was developed which permits the estimate of Th, Pa, U, Np, Pu, Am, and Cm in biological samples with a single technique. The radionuclides are extracted on a column by tri-n-octylphosphine oxide and separated by elution at different pH values. Afterwards, the quantitative determinations are done by physical methods (alpha counting or spectrometry). In the case of an accident it is possible to use a simplification of the procedure (extraction in a beaker) for checks. A procedure for the rapid determination of actinides in feces and in nasal secretions is described. Author (NSA)

N76-29385# Commissariat a l'Energie Atomique, Saclay (France). Div. de Chimie.

COMPARATIVE STUDY OF SOME ELECTROANALYTICAL TECHNIQUES. APPLICATION ON THE DETERMINATION OF TRACE METALLIC CATIONS

M. Carrier Jan. 1976 101 p refs In FRENCH
(CEA-R-4716) Avail: ERDA Depository Libraries HC $5.50

Methods often used in electroanalysis are compared. These are anodic stripping voltammetry and pulse stripping voltammetry, associated to three kinds of electrodes, hanging mercury drop electrode (EGPM), glassy carbon electrode (CV), mercury film electrode on glassy carbon (EFM). Sensitivity, reproducibility, and selectivity are considered. The importance is shown of the mercury film electrode during determination of metallic cations at low concentrations, or during simultaneous determination of elements like lead and thallium for which difference between half-wave potentials in polarography is very small. Author (NSA)

N76-29386# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.

RAPID METHOD FOR THE DETERMINATION OF MERCURY TRACES BY NEUTRON ACTIVATION ANALYSIS AND MERCURY CONTENT OF BIOLOGICAL MATERIALS OF DIFFERENT GEOGRAPHIC AND TIME ORIGINS

H. Rohde Aug. 1975 83 p In GERMAN
(KFK-2201) Avail: ERDA Depository Libraries HC $5.00

A rapid method based on activation analysis was developed for the determination of mercury in biological material. The method employs the delayed gamma rays as prompt gamma rays have been shown to display insufficient sensitivity. The mercury content of 182 fish derived from the waters of the region of southwestern Germany was determined. Relatively high concentrations (> 1 ppM) were measured in the muscle of Rhine fish. Similar mercury contents were observed in aged biological material (bird feathers and human hair) and contemporary living organisms. Author (NSA)

N76-29387# Defence Research Establishment Ottawa (Ontario).

MODULATION BROADENING OF SECOND DERIVATIVE GAUSSIAN AND LORENTZIAN LINES

A. W. Johnson Feb. 1976 15 p refs
(AD-A021309; DREO-TN-75-31) Avail: NTIS CSCL 14/2

The broadening of second derivative Gaussian and Lorentzian absorption lines has been calculated as a function of modulation amplitude. It is shown that Lorentzian lines are more sensitive to modulation-induced distortion than Gaussian lines. For modulation levels less than 0.2 (half-width at half-height), broadening is less than 1% for Gaussian lines and 2% for Lorentzian lines. Author (GRA)

N76-29388# Colorado State Univ., Fort Collins. Dept. of Chemistry.

STAIRCASE VOLTAMMETRIC STRIPPING ANALYSIS AT THIN FILM MERCURY ELECTRODES Interim Report

Uri Eisner, John Turner, and R. A. Osteryoung Feb. 1976 25 p refs
(Contract N00014-76-C-0092; Grant NSF MPS-575-0332; NR Proj. 359-493)
(AD-A022347; TR-5) Avail: NTIS CSCL 07/4

Anodic stripping voltammetry (ASV) is a powerful analytical tool for trace metal analysis. In this paper, an experimental study of the staircase ASV is presented. The various parameters governing the stripping current were studied, and analytical applications for the determination of low level trace metals were demonstrated. Anodic stripping voltammetry from a rotating thin film mercury electrode has been carried out employing a staircase waveform. Experimental results are shown to be in excellent agreement with previously developed theory. The method is of the same order of sensitivity as differential pulse stripping, but is much faster to perform. Reproducibility is better than 1% on the same film and 5% on replated films at the 10 ppb level. GRA

N76-29389# Naval Weapons Engineering Support Activity, Washington, D.C.

EVALUATION OF ALTERNATIVE BASE OIL VISCOSITIES FOR SPECTROMETRIC CALIBRATION STANDARDS

Richard A. Short and J. Sharon McCreery May 1975 35 p
(AD-A022338; NAVWESA-R-7504) Avail: NTIS CSCL 07/4

This study was to discover whether or not the level of accuracy obtained by spectrometric analysis is significantly affected by a change in the viscosity of the base oil used in the preparation of calibration standards. The 37.9 and 245.0 viscosity base oils were examined over a range of 12 elements and six concentration levels. No statistically significant difference was found. GRA

N76-29390# Naval Weapons Engineering Support Activity, Washington, D.C.

CORRECTION TABLE DETERMINATION FOR CONVERTING BETWEEN ATOMIC ABSORPTION AND ATOMIC EMISSION SPECTROMETER READINGS Final Report

Richard W. Lynch and Richard A. Short Jul. 1975 86 p ref (AD-A022339; P-7506) Avail: NTIS CSCL 07/4

Atomic Absorption (AA) spectrometers and Atomic Emission (AE) spectrometers are currently used by various oil analysis programs to measure the concentration of certain critical wearmetals present in oil samples. This concentration is usually expressed in parts per million (PRM) of the wearmetal being measured. The oil samples are taken from machinery, such as engines and gearboxes, and the wearmetal concentration monitored in an attempt to detect mechanical trouble developing in the oil source. The AA spectrometers and the AE spectrometers have been observed to give significantly different concentration readings for the same used oil sample. This paper proposes regression analysis to estimate correction tables to relate AA readings to AE readings for a given element and a given source of oil. These correction tables would allow oil samples from a piece of machinery to be sent to the nearest available spectrometer regardless of type. GRA

N76-29391# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

BAND MODEL PARAMETERS FOR THE 4.3-MICRONS FUNDAMENTAL BAND OF CO2 IN THE 100-3000 K TEMPERATURE RANGE Interim Report

Stephen J. Young 19 Feb. 1976 24 p

(Contract F04701-75-C-0076; DARPA Order 2843)

(AD-A021786; TR-0076(6754-03)-1; SAMSO-TR-76-35) Avail: NTIS CSCL 07/4

A set of band model parameters for CO2 in the 4.3 micrometer spectral region and consistent for the entire temperature range from near ambient atmospheric temperatures to gas combustion temperatures is constructed. This construction is accomplished by joining together band model parameters derived from atmospheric absorption line data compilation and tabulated parameters. Examples of the deficiencies of the sets are presented by comparison of predicted spectra with experimental absorption and emission spectra for low and high temperature gas samples. Author (GRA)

N76-29392# ARO, Inc., Arnold Air Force Station, Tenn.

TABLES OF THE THERMODYNAMIC PROPERTIES OF AIR AND THE EXHAUST GAS FROM A TURBINE ENGINE Final Report, 31 Jul. 1972 - 30 Jun. 1974

John M. Pelton and K. L. Hannah AEDC Mar. 1976 167 p refs

(AD-A021954; ARO-ETF-TR-75-93; AEDC-TR-76-16) Avail: NTIS CSCL 07/4

Thermodynamic properties of air and the exhaust gas from a turbine engine (C(n)H(1.95n))/Air System) are presented in tabular form. The properties presented air enthalpy (h), entropy (s), and specific heat at constant pressure (cp). The properties of air are presented for a temperature range from 300 to 1,800R and a pressure range from 0.5 to 600 psia. The properties of exhaust gas are presented for a temperature range from 600 to 4,000R, a pressure range from 0.5 to 600 psia, and a fuel-to-air ratio from 0.005 to 0.067. GRA

N76-29393# ARO, Inc., Arnold Air Force Station, Tenn.

TRANSMISSION OF DOPPLER BROADENED RESONANCE RADIATION THROUGH ABSORBING MEDIA WITH COMBINED DOPPLER AND PRESSURE BROADENING (NITRIC OXIDE GAMMA-BANDS AS AN EXAMPLE) Final Report, 1 Jul. 1974 - 30 Jun. 1975

M. G. Davis, W. K. McGregor, J. D. Few, and H. N. Glassman AEDC Feb. 1976 83 p refs

(ARO Proj. R32P-54; ARO Proj. R32P-55A)

(AD-A021061; ARO-ETF-TR-75-115; AEDC-TR-76-12) Avail: NTIS CSCL 07/4

The combined Doppler and pressure broadening parameter has been determined for the 0,0 gamma-band of nitric oxide (NO) by comparing measured spectral transmission data with the computer transmission using a radiative transfer model. The parameter (a', the ratio of collisional plus natural half-width to the Doppler half-width) was found to obey the relationship a' = Cp/T, where p is the pressure in atmospheres, T is the temperature in K, and C is a constant. The value of C was found to be 1,270 + or - 200 K/atm. This value of C leads to a value for the optical diameter of NO for broadening of 3,5 + or - 0.3 A. The determination of the broadening parameter oermits the accurate calculation of the transmission of NO gamma-band radiation through the high temperature, ambient pressure media corresponding to jet engine exhausts, in turn making possible the relating of transmission measurements to the concentration of NO. The application of the measurement and calculating procedure to the measurement problem is discussed. GRA

N76-29394# United Technologies Research Center, East Hartford, Conn.

INTERNAL CATALYST BREAKUP PHENOMENA Final Report, Jun. 1974 - Dec. 1975

A. S. Kesten and P. J. Marteney Dec. 1975 45 p refs

(Contract F04611-74-C-0031)

(AD-A022243; AFRPL-TR-75-68) Avail: NTIS CSCL 07/4

The use of hydrazine catalytic reactors for a wide variety of extended life missions is presently limited by degradation of the catalyst particles as evidenced by breakup of the particles. Fracturing of a catalyst particle can be caused by large pressure gradients or thermal stresses within the particle which cannot be supported by the porous structure. In previous studies, wetting by liquid hydrazine had been shown to lead to gas pressure buildup in catalyst particles, followed, under some conditions, by particle fracture. In this experimental study, individual Shell 405 catalyst particles of various size and history were mounted in a flow reactor in which the effects of hydrazine temperature, flow velocity, and exposure time on wetting and breakup could be determined. Particle wetting has been found to be strongly controlled by liquid hydrazine temperature; greatest wetting and most frequent breakup occur in particles exposed to lowest hydrazine temperatures. Tests of catalyst exposed to contaminants or decomposition product poisons indicated that in most cases activity was decreased and breakage was increased. The effects of thermal shock and thermal cycling were examined in a series of screening tests by rapid heating and cooling of particles. Single and multiple cycles were applied to individual particles. GRA

N76-29395# Arizona Univ., Tucson. Dept. of Chemistry.

PROGRAMMING TECHNIQUES FOR CHROMATOGRAPHIC EXPERIMENTS Technical Report, 1 Feb. 1974 - 1 Feb. 1976

J. B. Phillips and M. F. Burke 24 Feb. 1976 24 p refs Presented at Symp. on Computers in Chromatog. at the ACS Centennial Meeting, New York, 4 Apr. 1976 Submitted for publication

(Contract N00014-75-C-0512; NR Proj. 051-518)

(AD-A021245; TR-7) Avail: NTIS CSCL 07/4

The use of a multilevel structural programming technique for manipulation of chromatographic experiments and data is described. Examples are developed ranging from experimental control and analytical methods of computation to digital simulation of chromatographic processes. GRA

N76-29396# Brown Univ., Providence, R.I. Dept. of Chemistry.

THE COMPOSITION DEPENDENCE OF GLASS TRANSITION PROPERTIES

J. M. Gordon, G. B. Rouse, J. H. Gibbs, and William M. Risen, Jr. 27 Feb. 1976 45 p

(Contract N00014-75-C-0883; NR Proj. 051-539)

(AD-A021719; TR-76-01) Avail: NTIS CSCL 07/4

The composition dependence of the glass transition temperature (T sub G) and the composition dependence of supercooled liquid transport properties for binary mixtures are derived from the viewpoint of the configurational entropy theory of glassification. Theoretical expressions can be evaluated with available thermodynamic data. These derived relations are shown to reduce to the empirical equations which describe the composition dependence of T sub G and of supercooled liquid transport properties, and the empirical adjustable parameters are identified with physically meaningful quantities. An equation for the composition dependence of T sub G is compared with experimental data from binary mixtures with satisfactory agreement. GRA

N76-29397# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SINGLE AND DOUBLE CLUSTERING OF NITROGEN TO Li (+) Final Report
L. R. Gatland, L. M. Colonna-Romano, and G. E. Keller Feb. 1976 44 p refs
(DA Proj. 1T1-61102-B-53A)
(AD-A021522; BRL-1858) Avail: NTIS CSCL 07/4

The clustering of nitrogen molecules to positive lithium ions has been studied experimentally using a drift tube. Two cluster ions were observed, a lithium ion with one attached nitrogen molecule and a lithium ion with two attached nitrogen molecules. The rate coefficients for the reactions which lead to the formation and destruction of these cluster ions have been measured as a function of the translational energy of the ions. The mobilities of positive ions of lithium and of the cluster ions drifting in nitrogen were also measured. Author (GRA)

N76-29398# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
SPUTTER ION MASS SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES
F. G. Satkiewicz and H. K. Charles, Jr. Oct. 1975 55 p refs
(Contract N00017-72-C-4401)
(AD-A022052; APL-JHU-TG-1284) Avail: NTIS CSCL 10/2

The capabilities of the Applied Physics Laboratory include solar simulators and control cell standards for proper testing and evaluation of solar cell performance, controlled temperature and atmosphere furnaces to study the effects of ambient gases (surface effects) and impurity diffusion (junction effects), and a sputter ion source mass spectrometer (SIMS) that can provide both ionic and polyatomic species versus depth profiles for the Cu2S/CdS samples. Analysis of surface species before and after ambient exposure may lead to the development of effective surface coatings. Profile data through the junction region may aid in the study of impurity diffusion, which is believed to be a chief source of temperature degradation in the Cu2S/CdS system. An exploratory study was conducted to determine the feasibility of the SIMS technique. This report summarizes its results. GRA

N76-29399# New York Univ., N.Y. Dept. of Chemistry.
PHOTOELECTRON SPECTROSCOPY OF LIQUIDS: EXTERNAL IONIZATION ENERGIES
L. Nemec, L. Chia, and L. Delahay Dec. 1975 17 p refs
(Contract N00014-75-C-0397; NR Proj. 051-258)
(AD-A022036; TR-3) Avail: NTIS CSCL 20/10

A method is reported for the determination of ionization energies of liquids or solutions by means of photoelectron spectroscopy (PES). The method is based on the determination of second derivative of the quantum yield (with respect to retarding potential) as a function of retarding potential. The resulting spectrum for liquid is compared to gas-phase PES, and the liquid-gas photoionization shift is explained. This is, to our knowledge, the first determination of its kind in liquid-phase ultraviolet PES. A number of applications is foreseen.
Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-29400*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
INFLUENCE OF GASEOUS HYDROGEN ON THE MECHANICAL PROPERTIES OF HIGH TEMPERATURE ALLOYS Final Report
Jul. 1976 87 p
(Contract NAS8-30744)
(NASA-CR-149962; FR-7746) Avail: NTIS HC $5.00 CSCL 11F

Tensile tests of six nickel-base and one cobalt-base alloy were conducted in 34.5 MN/sq m helium and hydrogen environments at temperatures from 297 K to 1,088 K. Mechanical properties tests of the nickel-base alloy MAR M-246 (Hf modified), in two cast conditions, were conducted in gaseous environments at temperatures from 297 K to 1,144 K and pressures from one atmosphere to 34.5 MN/sq m. The objective of this program was to obtain the mechanical properties of the various alloys proposed for use in space propulsion systems in a pure hydrogen environment at different temperatures and to compare with the mechanical properties in helium at the same conditions. All testing was conducted on solid specimens exposed to external gaseous pressure. Smooth and notched tensile properties were determined using ASTM tensile testing techniques, and creep-rupture life was determined using ASTM creep-rupture techniques. Low-cycle fatigue life was established by constant total strain and constant stress testing using smooth specimens and a closed-loop test machine. Author

N76-29401*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF PRODUCING COMPLEX ALUMINUM ALLOY PARTS OF HIGH TEMPER, AND PRODUCTS THEREOF Patent Application
Irvin J. Wilson, inventor (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Filed 26 Jul. 1976 12 p
(Contract NAS9-14000)
(NASA-Case-MSC-19693-1; US-Patent-Appl-SN-708771) Avail: NTIS HC $3.50 CSCL 11F

Fully annealed aluminum sheet is first stretch formed to the complex, doubly compound shape of a previously prepared forming die, e.g., an ejection seat blowout panel of a shuttlecraft. The part is then marked with a series of grid lines for monitoring later elongation. Thereafter it is solution heat treated and refrigerated to retard hardening. While still soft, it is stretched a second time on the same die to induce a modicum of work hardening, after which it is aged to the desired stress corrosion resistant temper, perferrably the T8 level, to provide the desired hardness and stress corrosion resistance. NASA

N76-29402# Commission of the European Communities, Petten (Netherlands). Joint Research Center.
INVESTIGATION ON THE RELEASE OF STORED ENERGY FROM POLYCRYSTALLINE COPPER AT ROOM-TEMPERATURE BY TORSION
E. Lang 1975 28 p refs
(EUR-5343e) Avail: ERDA Depository Libraries HC $5.00

Recrystallization of 5N copper samples which had been deformed at room temperature by torsion to an average shear of gamma = 1.75 was investigated by means of a heatflow calorimeter. During the recrystallization process which was also studied by hardness tests and optical microscopy, a stored energy of 0.15 cal/g was released. By kinetic analysis based on the variation of the linear heating rate, a value of 0.95 eV was determined for the activation energy of the recrystallization.
Author (ERA)

N76-29403# Sandia Labs., Livermore, Calif.
THEORY OF DIFFUSION AND TRAPPING OF HYDROGEN AND HELIUM IN METALS, A REVIEW
W. D. Wilson Nov. 1975 27 p refs Presented at Intern. Conf. on Radiation Damage in Metals, Gatlinberg, Tenn., 6-10 Oct. 1975
(Contract AT(29-1)-789)
(SAND-75-8740; Conf-751006-23) Avail: NTIS HC $5.00

The theory of trapping and diffusion of helium and hydrogen in metals is reviewed. The fundamental aspects of the behavior of these particles are emphasized and hence ab initio methods of calculation of interatomic potentials are described. In particular, two-body free-electron and Hartree-Fock calculations for closed shell systems are described and compared for an example case, He-Cu+. Helium defect aggregates studied using these potentials are reviewed and several previously unreported calculations of helium clustering in tungsten are given. A brief discussion of the quantum nature of the diffusion of light particles is also given. Author (NSA)

N76-29404# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
DETERMINATION OF OXYGEN IN METALS USING AN IMPULSE HEATING FURNACE EQUIPPED WITH A SAMPLE TRANSFER LOCK

L. S. Dale, S. deJong, J. W. Kelly, and R. N. Whittem May 1975 16 p refs
(AAEC/E-352) Avail: ERDA Depository Libraries HC $3.50

An impulse heating furnace was constructed for the determination of low levels of oxygen down to 100 micrograms/g in metals. The furnace is equipped with a sample transfer lock which permits samples to be loaded into outgassed crucibles in a helium atmosphere. As a result, blank levels in the range 2 to 3 micrograms oxygen are obtained; the modification also results in shorter sample processing time. The apparatus is described, and its suitability for oxygen determinations at these levels is verified by comparison of results obtained on reference and analyzed materials. Author (NSA)

N76-29405# Army Materials and Mechanics Research Center, Watertown, Mass.

TEXTURE OF Ti-6 Al-4V AS AFFECTED BY ROLLING TEMPERATURE Final Report

Anthone Zarkades Dec. 1975 13 p refs
(DA Proj. 1T1-62105-A-328)
(AD-A021405; AMMRC-TR-75-25) Avail: NTIS CSCL 11/6

An experimental investigation was carried out to determine the effect of rolling temperature on the texture development in Ti-6 Al-4V. All specimens were unidirectionally rolled to a reduction of approximately 90 percent. A set of mill-annealed, as-received material was rolled between 1,200 and 1,650 F. Three additional specimens were solution treated, aged, and rolled at the aging temperatures of 1,100, 1,150, and 1,200 F. Attempts to cold roll these plates were unsuccessful due to cracking. Textures were determined for all material processed. Although improvements of the strain ratios over the as-received material were noted, these were considered low. GRA

N76-29406# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

STUDIES OF DEFORMATION AT SLIDING WEAR TRACKS IN IRON Final Report, Jan. - Dec. 1975

A. W. Ruff Jan. 1976 57 p refs
(Contract NAonr-35-75)
(AD-A021295; NBSIR-76-992) Avail: NTIS CSCL 11/6

Determinations of strains have been made on the surface and subsurface on specimens of high purity iron after different amounts of sliding wear have taken place. The method involved the measurement of loss of intensity (contrast) of particular electron channeling lines obtained from small selected areas near the wear track. Through the use of a calibration specimen deformed plastically to a range of strain values, the channeling line contrast loss was related to plastic strain. Strain maps lateral to the wear track and below the original surface were obtained for different total sliding distances by removing controlled thicknesses of iron using electropolishing. In all cases the maximum strain was found at the track center location at the surface and the strains decreased steadily with depth below the track. At 50 g load the strains vanished at about 40 micrometer depth. Significant strains were found to exist outside the wear track boundaries. The results are compared with other studies previously reported. GRA

N76-29407# Army Materials and Mechanics Research Center, Watertown, Mass.

EROSION AND FATIGUE BEHAVIOR OF COATED TITANIUM ALLOYS FOR GAS TURBINE ENGINE COMPRESSOR APPLICATIONS Final Report

Milton Levy and Joseph L. Morrossi Feb. 1976 21 p
(DA Proj. 1T1-62105-AH-84)
(AD-A022344; AMMRC-TR-76-4) Avail: NTIS CSCL 11/6

The erosion and fatigue behavior of several potentially protective coatings for reducing the severity of sand erosion degradation of titanium alloys was studied. The coatings can be ranked in the following order of decreasing merit incorporating erosion indices at 30, 60, and 90 degrees impingement: titanium carbonitride (nickel interlayer); titanium diboride (nickel interlayer); boron carbide; diffusion-bonded electroless nickel plus overlay of chromium; diffusion-bonded electroless nickel; and plasma-sprayed boron. All coatings caused fatigue strength reductions of between 22% and 80%. Shot peening reduced fatigue degradation in some cases. GRA

N76-29408# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.

BASIC MECHANISMS PROVIDING OXIDATION RESISTANCE IN STRUCTURAL METALS AT HIGH TEMPERATURES. VOLUME 1: THE EFFECT OF GASEOUS PRETREATMENT AND OXIDE SINTERING ON OXIDATION OF Ti-4.32 wt. PERCENT Cb AND Ti-0.96 wt. PERCENT Si Final Report, 21 Dec. 1973 - 20 Dec. 1974

C. J. Rosa Aug. 1975 150 p refs
(Contract N62269-74-C-0300)
(AD-A021455; NASC-0300-4-Vol-1) Avail: NTIS CSCL 11/6

The effects of nitrogen pretreatment at the oxidation temperature of 900, 1,000 and 1,100 C, and of oxide sintering at 100 C above the respective oxidation temperature have been investigated in an attempt to reduce the oxidation rates of the Ti-4.32 wt.% Cb and Ti-0.96 wt.% Si alloys. GRA

N76-29409# Naval Research Lab., Washington, D.C.

A STUDY OF HYDROGEN SULFIDE ACCELERATED STRESS-CORROSION CRACKING IN D6AC STEEL Interim Report

W. H. Cullen Jan. 1976 36 p refs
(WR0220101; NRL Proj. F01-24)
(AD-A021479; NRL-MR-3200) Avail: NTIS CSCL 11/6

Stress-corrosion cracking data for various tempers of D6AC steel is presented. The data pertain to aqueous and to gaseous hydrogen sulfide environments. The data show that the effect of increased tempering temperature increases the stress intensity threshold for stress-corrosion crack growth and in general decreases the velocities at any given stress intensity level. The effect of the hydrogen sulfide, compared to water, is to dramatically increase the velocities by two to three orders of magnitude, but the general shape of the velocity to stress intensity dependence remains unchanged. The tensile ligament instability model for subcritical crack growth is applied to the data. The increase in crack growth rates in going from aqueous to gaseous H_2S environments is explained in terms of a velocity parameter of the model. GRA

N76-29410# Washington Univ., Seattle. Dept. of Mechanical Engineering.

DYNAMIC PHOTOELASTIC ANALYSIS OF THREE FRACTURE SPECIMENS

A. S. Kobayashi and S. Mall Jan. 1976 31 p refs
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A021589; TR-24) Avail: NTIS CSCL 11/6

Previous dynamic photoelasticity results on single edge-notched tension plates without and with stringer reinforcements, dynamic tear test (DTT) specimens and wedge-loaded double cantilever beam (DCB) specimens are reviewed and some common fracture dynamic features in these three specimens machined from 9.53 mm thick Homalite-100 plates are discussed. Comparisons between dynamic finite element and dynamic photoelastic analyses of single edge-notched tension plates and one-dimensional dynamic, and dynamic photoelasticity analyses of wedge-loaded DCB specimens verified the existence of large fluctuations in dynamic stress intensity factors during crack propagation in the specimens considered in these investigations. GRA

N76-29411# Naval Research Lab., Washington, D.C.

A SELF-CONSISTENT THEORY OF STEADY-STATE LAMELLAR SOLIDIFICATION IN BINARY EUTECTIC SYSTEMS Final Report

G. E. Nash 9 Feb. 1976 170 p refs
(WR0220101; NRL Proj. M01-32)
(AD-A021887; NRL-7956) Avail: NTIS CSCL 11/6

The potential theoretic methods developed recently at NRL for solving the diffusion equation are applied to the free-boundary problem which describes lamellar solidification in binary eutectic systems. By using these techniques, the original free-boundary problem is reduced to a set of coupled nonlinear integro-differential equations which when solved yield the shape of the solid/liquid interface and the solute concentration on the interface. The behavior of the solution to these equations is discussed in a qualitative fashion, leading to some interesting interferences regarding the nature of the eutectic solidification process. Using the information obtained from the analysis, an approximate theory

of the lamellar-rod transition is formulated. The predictions of the theory are shown to be in qualitative agreement with experimental observations of this transition. In addition a simplified version of the general integro-differential equations is developed and used both to assess the effect of interface curvature on the interfacial solute concentrations and to check the new theory for consistency with experiment. GRA

N76-29412# Naval Civil Engineering Lab., Port Hueneme, Calif.
INSPECTION OF OBJECTS RETRIEVED FROM THE DEEP OCEAN-AUTEC ACOUSTIC ARRAY Technical Note, Feb. - Oct. 1973
J. F. Jenkins Feb. 1976 27 p
(AD-A021892; CEL-TN-1424) Avail: NTIS CSCL 11/6

Information on the corrosion of materials exposed to marine environments must be obtained if ocean structures are to be designed with predictable lifetimes. A large amount of relevant information can be obtained at a relatively low cost by evaluating the condition of objects retrieved from the sea. To optimize these evaluations, they must be performed logically and uniformly. Development and application of guidelines for such evaluations can provide this optimization. As a part of the development of guidelines, this report describes an evaluation of the AUTEC acoustic array emplaced in 1962 and retrieved from the Tongue-of-the-Ocean, Bahama Islands, after 12 years of exposure. The condition of the array as well as the application and revision of the inspection guidelines are discussed. Author (GRA)

N76-29413# Battelle Columbus Labs., Ohic.
DYNAMIC CRACK PROPAGATION AND ARREST IN STRUCTURAL STEEL Final Report, Sep. 1971 - Jan. 1975
George T. Hahn, Richard G. Hoagland, and Alan R. Rosenfield 1976 63 p refs
(Contract N00024-72-C-5142)
(AD-A021339; SSC-256) Avail: NTIS CSCL 11/6

This is the second of two Ship Structure Committee reports describing a three-year investigation of the crack propagation and arrest characteristics of ship-hull steels. The earlier report (SSC-242), which dealt principally with development of experimental and analytical techniques, is briefly discussed. Results are then presented for the following steels: ASTM-A517F (high strength low alloy), 9% Ni (for cryogenic service), ABS-C and ABS-E (two plates, one of which is high strength and designated EH). GRA

N76-29414# Imperial Coll. of Science and Technology, London (England). Dept. of Metallurgy and Materials Science.
THE MECHANISM OF HYDROGEN EMBRITTLEMENT IN NICKEL Final Technical Report, Jan. - Jun. 1975
Stephen L. Sass and Peter R. Swann Jun. 1975 19 p refs
(Grant DA-ERO-75-G-046; DA Proj. 1T1-61102-B-32D)
(AD-A021728) Avail: NTIS CSCL 11/6

Grain boundary cracking associated with the decomposition of nickel hydride in cathodically charged nickel was studied in the high voltage electron microscope. The occurrence of grain boundary cracking comes about from the presence of hydrogen at the boundaries and is not solely the result of the local boundary tensile stress due to the 5% difference in lattice parameter between the nickel and the hydride phases. In thin foil specimens grain boundary cracking occurs in the period of a few minutes after the end of cathodic charging, and does not continue in electron transparent regions during observation in the high voltage microscope. The susceptibility of grain boundaries to hydrogen-induced cracking is strongly dependent upon the structure of the boundary. Special boundaries, such as that of a twin, are particularly resistant to cracking. GRA

N76-29415# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
HYDRIDE PRECIPITATION IN Nb AND SOME PROPERTIES OF NbH
H. K. Birnbaum, M. L. Grossbeck, and M. Amano Feb. 1976 28 p refs
(Contract N00014-75-C-1012)
(AD-A021637) Avail: NTIS CSCL 11/6

The precipitation of the beta phase hydride from the solid solution has been studied using a variety of techniques including T.E.M., S.E.M., internal friction and resistivity methods. The effects of accommodation of the volume change which accompanies the beta phase precipitation are examined. A discussion of the solute effects on the alpha-beta solvus is presented. Stress effects on the alpha-beta solvus is discussed. In addition, some of the properties of the beta phase hydride is described. GRA

N76-29416# Dayton Univ. Research Inst., Ohio.
EVALUATION OF MATERIALS FOR AIR FORCE SYSTEMS AND HARDWARE APPLICATIONS Final Contract Report, 1 Jan. 1974 - 31 Dec. 1975
W. E. Berner and G. J. Petrak Wright-Patterson AFB, Ohio AFML Feb. 1976 297 p refs
(Contract F33615-74-C-5024; AF Proj. 7381)
(AD-A022275; UDRI-TR-75-49; AFML-TR-76-1) Avail: NTIS CSCL 11/6

This report summarizes the evaluation of a variety of materials and related engineering studies completed under contract to the Materials Support Division of the Air Force Materials Laboratory. It is divided into two sections, one covering mechanical properties of structural materials and the other the evaluation of nonstructural materials. Included in the first section are studies involving the crack resistance of B-1 materials and the evaluation of a landing gear side brace which were conducted in direct support of Air Force systems. Other more general studies were conducted on 7475 and X2040 aluminum alloys, Ti-6-4 and Ti-6-6-2 annealed forgings, beta processed titanium, and D6ac steel. The second section of the report describes in detail a comprehensive test program to evaluate elastomeric ground water seals for missile silos. High temperature sealants for use in F-111 and C-130 aircraft fuel tanks were also evaluated. Another program discussed involves the evaluation of O-ring packings in a dynamic test mode. Two structural adhesives were evaluated to determine their performance in a high temperature, high humidity environment. The final program discussed involves the evaluation of thermoplastics for use as rotating bands on 20mm projectiles. A total of eighteen injection molded thermoplastic materials were evaluated along with eleven adhesives and four primers. Results of the screening tests (Falling dart type) as well as actual gunfire testing are discussed. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-29417*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
THE STRESS DISTRIBUTION IN TEMPERED GLASS DUE TO A CRACK
K. Arin Jul. 1976 9 p refs
(Grant NsG-1178)
(NASA-CR-148602) Avail: NTIS HC $3.50 CSCL 11B

A model describing the failure in tempered glass is proposed and a method of solution is presented. An infinite elastic strip is assumed to represent the glass and the loads vanish everywhere on the boundary as well as at infinity. The problem is solved using the integral equations technique where the input is the residual stresses in the glass. Author

N76-29418# Polish Academy of Sciences, Warsaw.
POLYMER COMPOSITES [KOMPOZYTY POLIMEROWE]
Krzysztof Kunert and Jerzy Ranachowski 17 Dec. 1975 21 p refs In POLISH
Avail: NTIS HC $3.50

Products based on fibrous and binding carriers composed of synthetic resins and the purpose of creating composite materials are discussed. The prospects of utilizing polymers of special structure which will make possible the rise of a highly durable medium are described. The various theories dealing with composite polymer materials are briefly reviewed. Author

N76-29419*# San Jose State Univ., Calif. Dept. of Chemistry.
STUDY OF THERMAL STABILITY AND DEGRADATION OF FIRE RESISTANT CANDIDATE POLYMERS FOR AIRCRAFT

INTERIORS Final Report, Aug. 1975 - Jul. 1976
Ming-ta S. Hsu Jul. 1976 33 p refs
(Grant NsG-2093)
(NASA-CR-148567) Avail: NTIS HC $4.00 CSCL 11D

The thermochemistry of bismaleimide resins and phenolphthalein polycarbonate was studied. Both materials are fire-resistant polymers and may be suitable for aircraft interiors. The chemical composition of the polymers has been determined by nuclear magnetic resonance and infrared spectroscopy and by elemental analysis. Thermal properties of these polymers have been characterized by thermogravimetric analyses. Qualitative evaluation of the volatile products formed in pyrolysis under oxidative and non-oxidative conditions has been made using infrared spectrometry. The residues after pyrolysis were analyzed by elemental analysis. The thermal stability of composite panel and thermoplastic materials for aircraft interiors was studied by thermogravimetric analyses. Author

N76-29420# Army Materiel Command, Texarkana, Tex. Intern Training Center.
INVESTIGATIONS OF POSSIBLE KEVLAR UTILIZATION IN EXPLOSION PROTECTION STRUCTURES APPLICATIONS Final Report
Harris H. Yeager Dec. 1975 90 p refs
(AD-A022342; USAMC-ITC-02-08-76-412) Avail: NTIS CSCL 19/4

This report describes an investigation to determine the feasibility of using Kevlar 29 in suppressive shielding applications. The background, physical properties, general and specific applicability for suppressive shields, and results of a pilot test were discussed and analyzed. Comparison of the physical properties indicated superior effectiveness, ease of assembly, and weight characteristics of Kevlar 29 over steel. The material cost of Kevlar 29 is much higher than steel at present; therefore, specific designs must be compared to determine which structure has the lowest total cost. Kevlar 29 has possible applications in the seven suppressive shielding categories, yet more research is necessary to define blast effects and Kevlar 29's reaction to them. GRA

N76-29421# Edgewood Arsenal, Aberdeen Proving Ground, Md.
THE RESISTANCE OF POLYESTER, NYLON, AND MANILA ROPES TO HYDROCHLORIC ACID ATTACK Technical Report, Oct. 1974 - Feb. 1975
D. N. Hansen Feb. 1976 15 p
(DA Proj. 1J6-62627-AH-79)
(AD-A021971; EC-TR-76026) Avail: NTIS CSCL 11/7

This study was conducted in order to recommend a lifeline rope material which is more acid resistant than manila rope in dealing with massive acid spills. Testing showed that polyester ropes are about 50 times more resistant to HCl attack than normal manila ropes, and polyester rope is thus recommended for use in acid environment. The limitations for use of polyester ropes are discussed. Nylon ropes are not recommended for use. Author (GRA)

N76-29422# Frankford Arsenal, Philadelphia, Pa.
A PROTECTIVE GLASS COATING FOR PLASTIC OPTICAL COMPONENTS
John J. Walls, Jr. and Richard A. McKyton Jun. 1975 25 p refs
(DA Proj. 6747271)
(AD-A021538; FA-TR-75041) Avail: NTIS CSCL 11/3

A coating technique is described for the deposition of a protective glass coating on CR-39 plastic material. Deposition parameters such as the cleaning technique, an intermediate Cr binding layer, and the thickness of the glass coating have a significant effect on the adherence and abrasion resistant properties of the coated plastic. The optical and physical properties of the coated plastic are present as are several applications of this coating. GRA

N76-29423# Army Materials and Mechanics Research Center, Watertown, Mass.
EFFECT OF PROCESSING CONDITIONS ON MICROWAVE DIELECTRIC PROPERTIES OF REACTION-SINTERED SILICON NITRIDE Final Report
Donald R. Messier and Philip Wong Feb. 1976 10 p refs
(DA Proj. 1W3-62306-AH-72)
(AD-A021539; AMMRC-TR-76-3) Avail: NTIS CSCL 11/2

It is shown that unreacted silicon at levels above 0.5 to 0.6 weight percent seriously degrades the dielectric properties of reaction-sintered silicon nitride. The use of fine particle size silicon and various oxide additives were both effective in reducing unreacted silicon. Measurements of dielectric properties by two facilities were in good agreement, and those properties appear adequate for radome applications at temperatures up to the highest temperature of measurement, 1,000 C. GRA

N76-29424# Monsanto Research Corp., Dayton, Ohio.
INVESTIGATION OF NEW AIRDROP ENERGY DISSIPATER MATERIAL Final Report, 21 Jan. - 21 Nov. 1974
C. E. McClung, J. L. Schwendeman, I. O. Salyer, and A. L. Marcum Jul. 1975 99 p refs
(Contract DAAK03-74-C-0080; DA Proj. 1F2-62203-AH-86)
(AD-A021241; MRC-DA-476; NDC-TR-75-98-AMFL) Avail: NTIS CSCL 11/9

The object of this program was the development of a foam plastic which can be expanded by the user for use as an airdrop energy dissipater material. The approach included the development of a foam solution which can be shipped and stored in its unexpanded form, and the prototype equipment to generate rectangular pieces of foam. The developed formulation is based on polystyrene dissolved in a liquified gas. The gas acts as both a solvent and a pneumatogen for the polymer. Solvation is accomplished in a closed tank where the solution remains until needed. The prototype equipment produces foam with characteristics equivalent to more conventional polystyrene foams. The suitability of the foam as an airdrop energy dissipater material was not completely established and remains to be determined. GRA

N76-29425# Auerbach Associates, Inc., Philadelphia, Pa.
A STUDY OF FLAME RETARDANTS FOR TEXTILES Final Report
Thomas J. McGeehan and Jerome T. Maddock Feb. 1976 178 p refs
(Contract EPA-68-01-2209)
(PB-251441/2; AUER-2200-TR-4; EPA-560/1-76-004) Avail: NTIS HC $7.50 CSCL 11E

As part of a program for identifying potential environmental hazards associated with various branches of technology, a review of the literature on flame retardants for textiles has been prepared. Covering the periods 1954-74, more than 500 primary documents and consultations have been digested and cited. Chemicals and chemical treatments which are being used or have been proposed for producing flame retardant textiles are listed and discussed. Particular attention is given to toxicological data, to observations of health effects and to studies of environmental fates and effects of the materials which are used. The report is divided into major sections in which classes of natural and man-made textiles are considered separately. Several chemicals are identified as having their major application as flame retardants for textiles. These include certain halogenated monomers, halogenated phosphate esters, and formaldehyde derivatives of phosphorus and nitrogen compounds. Author (GRA)

N76-29426# Ceramic Finishing Co., State College, Pa.
LOCALIZED IMPACT DAMAGE IN CERAMICS
Henry P. Kirchner, Robert M. Gruver, and Craig S. Miller Jan. 1976 52 p refs
(Contract N00014-74-C-0241; NR Proj. 032-545)
(AD-A021496; TR-3) Avail: NTIS CSCL 11/2

Two topics are covered in this report: (1) localized impact damage in hot pressed Si3N4 and SiC and, (2) effect of leached surface layers on impact damage and remaining strength of Si3N4. The impact force necessary to form Hertz cracks in H.P. Si3N4 was about four times that for SiC. The Hertz cracks were characterized and the dimensions were compared with calculated values. The crack depths and the strength degradation were less than expected based on the available theory. H.P. Si3N4 was leached with HF and subjected to impact at low velocities by a tungsten carbide sphere. The remaining strength of the leached material after impact was substantially greater than that of impact damaged specimens that were not leached. The leached

layers prevented formation of Hertz cracks in the underlying material. Author (GRA)

N76-29427# Fabric Research Labs., Inc., Dedham, Mass.
NONFLAMMABLE FINISHES FOR USE IN FLIGHT CLOTHING Final Report, 1 Feb. 1974 - 30 Apr. 1975
Norman J. Abbott and J. S. Panto Dec. 1975 80 p refs
(Contract F33657-74-C-0397; AF Proj. 7320)
(AD-A022087; ASD-TR-75-39) Avail: NTIS CSCL 15/5

Nonflammable finishes were developed to improve the functional properties of fabric for flight clothing made from Nomex, Kynol, Kynol/Nomex blends and HT-4. Improvements in abrasion resistance, water repellency, electrostatic resistance, pilling and fuzzing resistance were obtained without adversely affecting flame and thermal resistance, breaking strength, tearing strength or moisture regain. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-29428# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Propulsion Directorate.
STINGER LAUNCH AND FLIGHT MOTOR SQUIB ELECTRICAL SAFETY AND FUNCTIONAL PERFORMANCE EVALUATION
Woodrow A. Williams Nov. 1975 46 p refs
(DA Proj. 1X3-64306-D-646)
(AD-A021962; RK-76-8) Avail: NTIS CSCL 16/4

This report provides the measured electrostatic sensitivity, resistance, no-fire current, all-fire current, ramp current, step current, and the Bruceton firing current estimated standard deviation values for the STINGER launch and flight motor squibs. The tests included one lot of 250 launch motor squibs and two lots of flight motor squibs (one contained 145 and the other 346). The values obtained from these evaluation tests exceed the Atlantic Research Corporation's specification requirements. One exception was the above tolerance pin-to-pin resistance value of 33% of the first lot of flight motor squibs. The high resistance did not adversely affect the functional performance. Another exception was the firing of one squib from the first lot of flight motor squibs near the end of the 1-ampere, 1-watt, 5-minute no-fire test. Author (GRA)

N76-29429# Bureau of Mines, Pittsburgh, Pa. Safety Research Center.
SUMMARY OF IGNITION PROPERTIES OF JET FUELS AND OTHER AIRCRAFT Final Report, 1 Jul. 1974 - 1 Jul. 1975
J. M. Kuchta Wright-Patterson AFB, Ohio AFAPL Sep. 1975 62 p refs
(Contract F33615-74-M-6251; AF Proj. 3048)
(AD-A021320; AFAPL-TR-75-70) Avail: NTIS CSCL 01/2

This report was prepared at the request of the Air Force to summarize the various ignition properties of jet fuels and other aircraft combustible fluids. The initial part is devoted to theory and definitions that are pertinent to ignition phenomena and the application of any experimental data. Other parts of this report summarize the various data that are available on ignition energies, ignition quenching distances and ignition temperatures of aircraft fuels, engine oils, hydraulic fluids and lubricants. Data are presented on the following types of ignition sources: Electrical sparks or arcs, frictional sparks, heated vessels or tubes, heated wires or rods, heated metal targets, jets of hot gases, shock wave and adiabatic compression, incendiary ammunition and self-heating. Author (GRA)

N76-29430# Naval Weapons Center, China Lake, Calif.
AN EXPANDED VARICOMP METHOD FOR DETERMINING DETONATION TRANSFER PROBABILITIES Final Report, Jul. 1971 - Jul. 1974
James E. Means Dec. 1975 74 p
(AD-A021890; NWC-TP-5789) Avail: NTIS CSCL 19/1

A method for (VARICOMP) for evaluating the interface between fuze explosive components is described. The method determines by statistical analysis and testing that the reliability and safety of a fuze explosive train can be predicted at high-confidence levels with a small number of tests. This is done by varying the sensitivity of different explosives that are then substituted into the explosive train of interest to determine the safety and reliability limits under a penalty test situation. For reliability tests the acceptor design explosive is replaced by a less sensitive VARICOMP explosive, whereas for safety evaluation a more sensitive explosive PETN is used. A sensitivity calibration was made of various design explosives and two different series of VARICOMP explosives desensitized RDX. The work differed from earlier similar efforts in that each explosive was calibrated using donors of three diameters (50, 100, and 200 mils). One of the VARICOMP mixes has a sensitivity to initiation nearly independent of diameter the other has a sensitivity to initiation highly dependent upon diameter. GRA

N76-29431# Naval Weapons Station, Yorktown, Va.
EVALUATION OF SYNTHETIC WAXES FOR DESENSITIZING EXPLOSIVES Interim Report, FY 1975
Winona C. Hogge and Edwin R. Cousins Nov. 1975 49 p refs
(AD-A022074; NWSY-TR-75-3) Avail: NTIS CSCL 11/7

A shortage of Grade A wax, MIL-W-20553B, for Navy HBX explosives resulted in several waxes being proposed as replacements. Thirteen samples, received for preliminary evaluation, were screened on the basis of differential scanning calorimetry results, exudation behavior at 71 C, compatibility with H-6 explosive, and incorporability in TNT. The three most promising candidates were selected for further testing against all of the requirements of the wax specification. Laboratory batches of H-6 were prepared using the candidate waxes. The H-6 was evaluated for processing, explosive characteristics, and behavior on thermal cycling between plus 71 C and minus 54 C. None of the candidate waxes performed as well as the standard wax and none are recommended for large scale HBX studies. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-29432# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
SEMI-ANNUAL REPORT ON MATERIALS RESEARCH IN SUPPORT OF SUPERCONDUCTING MACHINERY
R. P. Reed, J. G. Hust, M. B. Kasen, H. M. Ledbetter, D. T. Read, R. E. Schram, L. L. Sparks, and R. L. Tobier Apr. 1976 155 p refs
(ARPA Order 2560)
(PB-252013/8; NBSIR-76-839) Avail: NTIS HC $6.75 CSCL 11F

Results are reported of a six-month study on candidate materials for superconducting machinery. The results cover five areas--advanced composites, elastic properties, fatigue resistance and fracture toughness, magnetothermal conductivity, and thermal conductivity. Material properties were studied over the temperature range 4 to 300 K. Materials studied include: aluminum alloys 1100, 2014, 2219; a nickel-chromium-iron alloy; iron-47.5 nickel; and the composite materials boron/aluminum, boron/epoxy, S-glass/epoxy and graphite epoxy. GRA

N76-29433# Naval Ship Research and Development Center, Annapolis, Md. Dept. of Materials.
FIRE-PROTECTION STUDY OF HIGH-PERFORMANCE SHIPS
James R. Lugar and Charles M. Rollhauser Feb. 1976 86 p refs
(SF4345171)
(AD-A021939; MAT-75-46) Avail: NTIS CSCL 13/10

A study was conducted on the problems associated with fires aboard high-performance ships. Basic ship layouts and descriptions were reviewed along with the present firefighting

systems. Potential fire problems relating to construction materials, high fuel and payload capacities, gas turbines, and new habitability materials are discussed. Based on the study, it was determined that the state-of-the-art in fire detection and passive fire protection does not offer complete solutions to the fire threat. Present firefighting systems are considered inadequate to combat large fires or fires caused by hostile attack. No backup systems are provided if the existing Halon 1301 system fails to extinguish fires in the machinery spaces. Water is not readily available to combat class A fires throughout the ships. GRA

N76-29434# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
GUIDE FOR STRUCTUREBORNE VIBRATORY ACCELERATION MEASUREMENT OF NAVAL MACHINERY
D. Maxwell and R. W. Miller Mar. 1976 49 p refs
(AD-A021725; PAS-75-66) Avail: NTIS CSCL 13/10

This guide's purpose is to systematize vibration measurement procedures and to promote uniformity and clarity between the measurement techniques employed by government and contractor laboratories. This includes the instrumentation, techniques, and methods used in measuring, analyzing, and interpreting the vibratory acceleration (structureborne-noise) signal. GRA

N76-29435# Defence Research Establishment Suffield, Ralston (Alberta).
TOWARDS CONTROLLING SPRAY DROP SIZE
G. A. Hill and F. L. McCallum Jan. 1976 33 p refs
(AD-A021641; DRES-TP-439) Avail: NTIS CSCL 13/7

A vibrating nozzle has been developed for producing uniform drops at low frequencies and at a fixed wavelength. The device was found useful for producing monodisperse 1 mm to 3 mm drops of viscous fluids. Author (GRA)

N76-29436# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
IMPROVING HEAT PUMP PERFORMANCE VIA COMPRESSOR CAPACITY CONTROL - ANALYSIS AND TEST, VOLUME 1
Carl C. Hiller and Leon R. Glicksman Jan. 1976 204 p refs Sponsored in part by NSF
(PB-250592/3; MIT-EL-76-001-Vol-1; Rept-24525-96-Vol-1) Avail: NTIS HC $7.75 CSCL 13A

Past, present, and future developments in heat pump technology are outlined. One method of improvement, the capacity controlled heat pump, was studied in detail. An analysis of conventional and capacity controlled air-to-air heat pumps was performed using detailed computer simulations. New system sizing guidelines are outlined for capacity controlled units, resulting in as much as a 30% per year energy savings over conventional heat pumps in two of the six locations studied. GRA

N76-29437# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
IMPROVING HEAT PUMP PERFORMANCE VIA COMPRESSOR CAPACITY CONTROL - ANALYSIS AND TEST. VOLUME 2: APPENDICES
Carl C. Hiller and Leon R. Glicksman Jan. 1976 245 p refs Sponsored in part by NSF
(PB-250593/1; MIT-EL-76-002-Vol-2-App; Rept-24525-96-Vol-2) Avail: NTIS HC $8.00 CSCL 13A

Contents: Thermophysical properties of refrigerants; Carrier model 50 DQ series single package heat pumps; Sample thermodynamic cycle data from system simulations--conventional vs. capacity controlled heat pump; Details of system flow balance modeling; Details of compressor simulation model; Refrigerant-oil solubility; Compressor data; Parametric studies on Carrier 06D-537 compressor; Details of air-cooled, cross-flow condenser modeling; Complements to heat exchanger analysis; Heat transfer coefficients; Pressure drop relations; Details of cross-flow evaporator modeling; Capacity controlled 50 DQ 016 studies; Heat pump performance data for load line 'D' studies; Weather data. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-29438# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF THE PRODUCTION IMPROVED RADAR QUANTIZER GROUP MODIFICATION TO THE PRODUCTION COMMON DIGITIZER Final Report, Sep. 1974 - Feb. 1975
William C. Swanseen May 1976 26 p
(AD-A024750/2; FAA-NA-75-45; FAA-RD-76-5) Avail: NTIS HC $4.00 CSCL 17/9

An improved radar quantizer group (RQG) was installed in the Production Common Digitizer (PCD) located at the Elwood, New Jersey, National Aviation Facilities Experimental Center long range radar site. The modified RQG improves search target detection in radar clutter environments. A series of sybsystem and system tests was conducted to compile data comparing digitizer performance using the improved RQG/PCD with performance from an unmodified PCD. Test results indicate increased search target detection and reduced Automatic Clutter Eliminator (ACE) total blank in weather clutter areas. It was concluded that the modified PCD increased search track life in radar clutter environments. Author

N76-29439# Federal Aviation Administration, Washington, D.C.
INTEGRATED NATIONAL AIRSPACE COMMUNICATION SYSTEM (INACS) FOR THE SUPPORT OF AIR TRAFFIC CONTROL OPERATIONS IN THE 1980'S AND 1990'S. GROSS COST/BENEFIT ANALYSIS
15 Apr. 1976 58 p ref
(AD-A025152/0; FAA-INACS-061-221-CB) Avail: NTIS HC $4.50 CSCL 17/2

The methodology and the results are presented of a comparison of the gross costs of the present day communications system (projected) and the Integrated National Airspace Communications System (INACS) for the period 1982 through 1996. The projected INACS costs were structured to permit a near direct cost comparison with like subsystem elements in the present system. Author

N76-29440# Bell Aerospace Co., Buffalo, N.Y.
QM/PSK VOICE/DATA MODEM Final Report, Jan. 1974 - Apr. 1975
T. Lerner and J. McChesney Mar. 1976 96 p
(Contract DOT-TSC-631)
(AD-A024841/9; DOT-TSC-FAA-76-5; FAA-RD-76-63) Avail: NTIS HC $5.00 CSCL 17/9

Two Quadrature Modulation/Phase Shift Keyed Voice/Data Modem systems have been developed as part of the satellite communications hardware for advanced air traffic control systems. These systems consist of a modulator and demodulator unit which provides for the one-way communication of voice and/or data signals. The modulator and demodulator unit provides simultaneous transmission of analog voice and digital data signals multiplexed on a single carrier, using quadrature modulation techniques. The modem interfaces with the transmitter/receiver at 70 MHz intermediate frequency. The design theory, circuit descriptions, diagrams, calibration procedures, and laboratory test results are included. Author

N76-29441# Arinc Research Corp., Annapolis, Md.
A STUDY OF THE COMMUNICATIONS REQUIREMENTS FOR A 1985 TO 2000 OPERATIONAL AERONAUTICAL SATELLITE SYSTEM. VOLUME 2: PACIFIC AND INDIAN OCEAN AREAS Final Report, phase 2
Danny E. Cornett and J. Kent Haspert Mar. 1976 88 p
(Contract DOT-FA75WA-3544)
(AD-A025282/5; FAA-RD-75-80-Vol-2; Rept-1307-01-1-1401-Vol-2) Avail: NTIS HC $5.00 CSCL 17/2

The number of communications channels required by a global

aeronautical satellite network operating during the period 1985 to 2000 was determined. Requirements for Pacific Ocean and Indian Ocean systems are reported. Seven alternative operating scenarios were considered, and the communications channels required by each were evaluated. The evaluation entailed (1) the characterization of present oceanic communications traffic, (2) the estimation of future communications traffic as an extension of present-day traffic, and (3) the generation of operating scenarios and the determination of the number of communications channels required. Channel requirements were based on the assumption that a single control point would be used to control the use of channels, and calculations excluded any spare channels for system backup, emergency alerts, or dedicated continuous broadcast purposes. It was concluded that a maximum of seven forward and eight return channels for the Pacific Ocean system and five forward and eight return channels for the Indian Ocean system would accommodate the anticipated communications volumes in these areas through the year 2000. Author

N76-29442# Arinc Research Corp., Annapolis, Md.
A STUDY OF THE COMMUNICATIONS REQUIREMENTS FOR A 1985 TO 2000 OPERATIONAL AERONAUTICAL SATELLITE SYSTEM. VOLUME 3: EXAMINATION OF SELECTED OPERATIONAL ISSUES FOR AEROSAT EVALUATION Final Report, phase 2
Danny E. Cornett Mar. 1976 87 p refs
(Contract DOT-FA75WA-3544)
(AD-A025251/0; FAA-RD-75-80-Vol-3; Rept-1307-01-1-1401-Vol-3) Avail: NTIS HC $5.00 CSCL 22/2

The scope of the test planning required to execute the AEROSAT Test and Evaluation (T and E) Program was studied. Areas of examination include: (1) selection of viable operational concepts for evaluation, (2) capabilities and potential uses of a Mini-ASET, and (3) potential use of an AEROSAT during off-peak periods. Seven basic operational concepts and two expanded uses for an AEROSAT system were developed to describe the alternative communications services, operating modes, and message types and characteristics that should be considered for evaluation during the T and E program. While the findings are preliminary in nature, the study has identified and begun to clarify a number of issues including: fundamental combinations of services, modes and message types that should be included in the program; technical and operational factors associated with the selection of a preferred concept; reasons for considering Mini-ASET and off-peak services concepts, capabilities and applications of a Mini-ASET concept; application and implementation of an off-peak services concept; problem associated with the Mini-ASET and off-peak services concepts; and operational tests to be conducted during the T and E Program. Author

N76-29443*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE NASA TELECONFERENCING SYSTEM: AN EVALUATION
Mary M. Connors, George Lindsey, and Richard H. Miller May 1976 81 p refs
(NASA-TM-X-74160) Avail: NTIS HC $5.00 CSCL 17B

The communication requirements of the Apollo project led to the development of a teleconferencing network which linked together, in an audio-fax mode, the several NASA centers and supporting contractors of the Apollo project. The usefulness of this communication linkage for the Apollo project suggested that the system might be extended to include all NASA centers, enabling them to conduct their in-house business more efficiently than by traveling to other centers. A pilot project was run in which seventeen NASA center and subcenters, some with multiple facilities, were connected into the NASA teleconferencing network. During that year, costs were charted and, at the end of the year, an evaluation was made to determine how the system had been used and with what results. The year-end evaluation of the use of NASA teleconferencing system is summarized. Author

N76-29444*# National Aeronautics and Space Administration, Washington, D.C.
NASA TELECONFERENCE PILOT PROJECT EVALUATION FOR 1975
Samuel W. Fordyce Apr. 1976 15 p ref
(NASA-TM-X-74161) Avail: NTIS HC $3.50 CSCL 17B

Tabular data were given to summarize the results of the NASA teleconferencing network pilot project for 1975. The 1,241 evaluation reports received indicate that almost 100,000 man-hours of teleconferences took place. The travel funds reported saved total about $1.44 million, which is about 10% of the NASA travel costs. Subtracting the cost of providing the teleconferencing networks, the net savings reported are $1.28 million (about 9% of the travel costs). The teleconferencing network has proved to be successful in conducting many management meetings and reviews within NASA and its contractors. In spite of difficulties caused by inexperience in teleconferencing and some equipment and circuit problems, the evaluation reports indicated the system was satisfactory in an overwhelming majority of cases. Author

N76-29445# Office of Telecommunications, Washington, D.C.
ELECTROMAGNETIC COMPATIBILITY MEASUREMENTS AND ANALYSIS OF SYSTEMS IN THE 1,535-1,660 MHz BAND Final Report
A. C. Stewart, L. L. Haidle, R. D. Jennings, S. Murahata, and D. Vandermade 30 Jan. 1976 445 p refs
(Contract DOT-FA73WAI-323)
(AD-A024430/1; FAA-RD-75-229) Avail: NTIS HC $11.75 CSCL 17/9

Laboratory measurements were performed on a number of systems operating in the 1,535-1,660 MHz band to determine electromagnetic compatibility. These systems included: five types of radar altimeters operating in the 1,600-1,660 MHz band, three proposed air-to-air Collision Avoidance Systems (CAS) operating in the 1,592.5-1,622.5 MHz band, and a simulated Satellite Communication System operating in the 1,622.5-1,660 MHz uplink band and 1,535-1,578.5 MHz downlink band. The measurements revealed a distinct incompatibility between the three proposed CAS's and the APN-155, APN-159 and Bonzer TRN-70 radar altimeters; therefore, further analysis was performed to determine the effects of altimeter interference to CAS in an operational environment. Author

N76-29446# Polish Academy of Sciences, Warsaw.
PROPAGATION OF ELECTROMAGNETIC WAVES FROM A SEMI-INFINITE CIRCULAR CYLINDER INTO A HALF-SPACE [PROPAGACJA FAL ELEKTROMAGNETYCZNYCH Z POLNIESKONCZONEGO CYLINDRA KOLOWEGO W POLPRZESTRZEN]
Zofia Kurlandzka 6 Nov. 1975 66 p refs In POLISH
Avail: NTIS HC $4.50

An electromagnetic field in a zone consisting of a semi-infinite cylinder with a circular cross-section and a half-space is determined under the assumption that in the cylinder an electromagnetic wave is given. The boundary of the zone is established as ideally conductive. It is established that all the magnitudes occuring in the problem are periodic. The zone under consideration represents a simplified model of a mine shaft and the surface of the earth. The problem is the starting point for the description of electromagnetic wave propagation in a shaft where additional elements appearing in the shaft are considered. Author

N76-29447# Polish Academy of Sciences, Warsaw.
SUBJECTIVE PROBABILITY OF POLISH EXPRESSIONS [SUBIEKTYWNE PRAWDOPODOBIENSTWO WYRAZOW POLSKICH]
Wiktor Jassem and Danuta Szybista 19 Nov. 1975 158 p refs In POLISH
Avail: NTIS HC $6.75

Verbal audiometric word lists were compiled for school age children. The subjective probability of lexical units included in such lists is discussed. It is demonstrated that perception of language elements is connected with the force of anticipation, or the possibility of prediction on the part of the listener. This fact is applicable to auditory studies in the field of telecommunications, and psycholinguistic and neurophysiological studies. An experimental methodological basis is created for a more complete and better conceived project dealing with the problematics of

biocybernetics and telecommunications in the realm of perception and speech signal recognition. Author

N76-29448# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON THE CLOSE PACKING OF UNSYNCHRONIZED FDM WAVEFORMS
Brian E. White 14 Oct. 1975 102 p refs
(Contract F19628-76-C-0002)
(AD-A021412; TN-1975-34; ESD-TR-75-283) Avail: NTIS CSCL 17/2

The effects of crosstalk on unsynchronized FDM communication links operating in the presence of additive white Gaussian noise are considered for several modulation schemes. Continuous-phase frequency shift keying is found to be far superior to various forms of phase shift keying in the sense that many more uncoordinated frequency division multiplexed waveforms can be packed into a given bandwidth for a certain imbalance in transmitter powers. This result can be applied to the uplinks and/or downlinks of a demodulating communications satellite serving a multitude of mobile terminals. GRA

N76-29449# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SPEECH EVALUATION, VOLUME 1 Annual Report
Bernard Gold Jun. 1975 63 p refs
(Contract F19628-73-C-0002)
(AD-A021239; ESD-TR-75-297-Vol-1) Avail: NTIS CSCL 17/2

Two broad categories of work are described: algorithmic studies and hardware design. Several algorithms for digitizing and reducing the data rate of speech signals are described. These algorithms include an adaptive residual coder (ARC) designed to produce data at 16 and 9.6 kbps, an adaptive predictive coder (APC) at 8 kbps, a voice-excited linear predictor (VELP) at 8 kbps, and a straight linear predictive coded (LPC) vocoder at 2.4, 3.6, and 4.8 kbps. In addition, some work on pitch or excitation extraction is described. All these studies are evaluated on a realtime facility which is described. In the hardware design area, the digital voice terminal is described in detail, as well as some follow-on next-generation LSI studies. Volume II will contain a digital voice terminal (DVT) manual, program listings, and a cross assembler. GRA

N76-29450# Army Communications Systems Agency, Fort Monmouth, N.J.
DTEP (DIGITAL TRANSMISSION EVALUATION PROJECT) Annual Report, 1975
5 Feb. 1976 15 p
(AD-A022343) Avail: NTIS CSCL 17/2

The engineering evaluation project was established to derive an engineering data base in the area of wideband digital communication by testing and evaluating selected commercially developed communication equipment. This project provides the Defense Communications Agency (DCA), Department of the Army, and other MILDEPS information to guide modernization towards an all digital communication system. An engineering data base is being developed by conducting tests in both back-to-back (laboratory environment) and dynamic (over the air) configurations. This knowledge can then be used in the preparation of technical specifications, Military Standards, and for solving special problems. The purpose of this report is to provide a synopsis of significant effort which occurred on the DTEP during calendar year 1975. Topics discussed are management, manpower, funding and a technical analysis of equipments and techniques. GRA

N76-29451# Texas Univ., Austin. Applied Research Labs.
STUDIES ON THE PHASE SPECTRA OF VLF SFERICS
Robert T. Trochta and Claude W. Horton, Sr. 25 Aug. 1975 61 p refs
(AD-A017375/7; ARL-TR-75-47) Avail: NTIS HC $4.50 CSCL 20/14

The phase characteristics of long range sferic signals are studied in detail over the frequency range of 9 to 20 kHz. When the experimentally measured phase of a sferic is fitted with a straight line by the method of least squares, the deviation of the phase from this straight line shows a pattern that is characteristic of the nature of the propagation path. The phase deviation for daytime paths of length greater than 4,000 km behaves as predicted by the theoretical behavior of the first propagation mode -- daytime paths of ranges between 1,500 and 3,500 km can be explained by two modes. Author (GRA)

N76-29452# Harry Diamond Labs., Adelphi, Md.
SIGNAL ANALYSIS AND PARAMETERIZATION FOR EMP DATA
Thomas A. Tumolillo Sep. 1975 156 p refs
(AD-A020493; HDL-TR-1715) Avail: NTIS CSCL 17/2

Presented are the theoretical background, program description, and computer listings that describe the techniques to reduce and analyze digital time-series data obtained in electromagnetic-pulse testing of military communications systems. The topics treated include data preprocessing, digital filtering, fast Fourier transform, fast Walsh transform, refined spectral densities, autocorrelation functions, waveform representation by parametrized functions, and nonlinear, least squares techniques. Several examples of the data are analyzed and discussed. GRA

N76-29453# Culler/Harrison, Inc., Goleta, Calif.
SPEECH SIGNAL PROCESSING RESEARCH Final Technical Report, Mar. 1973 - Sep. 1975
Glen J. Culler, Michael McCammon, James F. McGill, Dale E. Taylor, and Jan M. Vanderford Dec. 1975 33 p refs
(Contract DAHC15-73-C-0252)
(AD-A020489; CHI-FIN-101) Avail: NTIS CSCL 17/2

During this period, Culler/Harrison, Inc. has developed a powerful, versatile signal processing capability for ARPA and utilized this capability to perform significant and diverse signal processing experiments. The contract called for construction, operation and maintenance of the CHI SIGNAL SYSTEM, a combination of equipment and software providing a unique marriage of computing power and on-line interactive control of that power. The system has proved its flexibility and reliability on a broad range of applications encompassing speech compression, on-line control of laboratory experiments, test editing and controlled thermonuclear reactor simulation. An on-line Interactive Math System was developed and implemented on the CHI SIGNAL SYSTEM under this contract. As a research tool, the SIGNAL Interactive Math System offers researchers the ability to develop sophisticated signal processing processes, to try out new approaches and receive numerical and graphical feedback on-line interactively, and all with button push turn-around time. The Interactive Math System has been retrofitted to an identical CHI SIGNAL SYSTEM which is playing an integral part in the ARPA Research Center, or ARC, located at Moffett Field, California. GRA

N76-29454# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORKS Quarterly Technical Report, 1 Oct. - 31 Dec. 1975
Frank E. Heart Jan. 1976 30 p refs
(Contract F08606-75-C-0032; ARPA Order 2351)
(AD-A020480; BBN-3236; QTR-4) Avail: NTIS CSCL 17/2

The ARPA Computer Network is a packet-switching store-and-forward communications system designed for use by computers and computer terminals. This Quarterly Technical Report briefly describes various aspects of network operation and maintenance, including IMP software modifications to permit more than 63 IMPs on the net and more than 4 Host computers on an IMP, and shipment of the first Private Line Interface to the field; and discusses in some detail the new TIP software to be released shortly, the Packet Satellite Demonstration and Satellite IMP activities, and recent development in Pluribus technology, plus a summary of accomplishments to date in the latter area. GRA

N76-29455# Harris Corp., Melbourne, Fla. Electronic Systems Div.
DIGITAL MODEM STUDY Final Report, 16 Apr. - 12 Sep. 1975
Martin C. Levergood 14 Nov. 1975 229 p refs
(Contract DCA100-75-C-0037)
(AD-A020795) Avail: NTIS CSCL 17/2

The report describes the results of Phase 1 of a two-phased program to demonstrate the technical feasibility of using a completely digital implementation for a modulator/demodulator (modem) and associated coder/decoder (codec). The subjects covered in the report consist of: design requirements; concept

design; analysis and test results of a critical subsystems breadboard; and a description of a resulting design plan including initial estimates of cost, reliability and maintainability. In addition, functional designs for selected options with initial cost estimates are covered. GRA

N76-29456# Cincinnati Electronics Corp., Ohio.
ELECTRONICALLY CONTROLLED FILTERS AND MULTI-COUPLERS Interim Report, 1 Mar. - 1 Aug. 1975
C. M. Morris and J. G. Vaal Dec. 1975 33 p refs
(Contract DAAB07-73-C-0218; DA Proj. 1S7-62705-AH-94)
(AD-A020967; ECOM-73-0218-3; IR-3) Avail: NTIS CSCL 17/2

This report covers the third period of the program and describes the design, fabrication and test of three Electronically Tunable Filters. These filters cover the frequency range of 30-80 MHz at an RF power level of 25 watts. The primary application of the filter is to use at the output of an FM Radio to help reduce the transmitter noise floor. A description of the design requirements are given, a system description provided test data presented on the three filters, and recommendations for improvements in future models discussed. Author (GRA)

N76-29457# Pattern Analysis and Recognition Corp., Rome, N.Y.
APPLICATIONS OF DICIFER Final Technical Report, Jul. 1974 - Sep. 1975
John C. Lietz, George E. Forsen, Frank H. Feng, Michael J. Zoracki, and Michael J. Gillotte Jan. 1976 131 p refs
(Contract F30602-74-C-0352; AF Proj. 6244)
(AD-A021084; PAR-75-25; RADC-TR-76-4) Avail: NTIS CSCL 15/4

The project effort was divided into two main application areas related in objective but different in sensor. Existing and new DICIFER routines were used to develop capability for: (1) detecting significant changes in aircraft count at military airbases using high-resolution, monochrome reconnaissance imagery, and (2) establishing a set of features for detection of tactical targets using high-resolution SAR imagery. The former required the addition of several new feature extraction and classification routines based on shape (Part I). The latter effort was largely experimental (Part II). In addition, a short study (Part III) was made to determine the extent to which information-lossless data compaction techniques could be used to increase the number of images that could be stored on DICIFER. Author (GRA)

N76-29458# Defense Communications Engineering Center, Reston, Va.
DESIGN OF A DEMAND ASSIGNMENT SATELLITE NETWORK
N. Kyriakopoulos Dec. 1975 30 p refs
(AD-A021937; TN-39-75) Avail: NTIS CSCL 17/2

The report presents a step by step procedure for the design of a single-channel per-carrier, demand assignment, satellite communications network. The input for the design is the traffic matrix to be handled by the network, and the outputs are the bandwidth and power requirements for the satellite system. Although the design approach is general, a specific example chosen to illustrate the technique is the intra-European switched-traffic voice network. GRA

N76-29459# Defense Communications Engineering Office, Reston, Va.
COMMUNICATIONS NETWORK TIMING
Harris A. Stover Sep. 1975 98 p refs
(AD-A021934; TR-43-75) Avail: NTIS CSCL 17/2

The report is intended to provide the reader with sufficient information to develop his own intuitive insight into questions related to timing of switched digital networks employing time division multiplexing. It describes timing requirements inherent in such networks. It describes a number of basic techniques any one of which is capable of fulfilling these requirements. It presents possible objectives for a DCS timing concept, provides additional background relative to timing in the DCS, and discusses provisions for system interfaces which can be advantageous. This technical report does not attempt to show that any one basic technique should be used to the exclusion of all others, but recommends a timing approach which employs several basic concepts, each where it best matches the needs of the network. It is an approach which permits an orderly evolution from the present timing status to a much more capable system. Although it is not an approved DCA approach, it is a tentative approach which will be subjected to considerable further study (along with other approaches) to either verify its desirability or recommend changes. GRA

N76-29460# Harris Corp., Rochester, N. Y. Communications Div.
TRANSISTORIZED RF POWER AMPLIFIER AND DRIVER FOR RECEIVER TRANSMITTERS RT-246/VRC AND RT-524/VRC Quarterly Report, May - Sep. 1975
B. Williams Dec. 1975 51 p
(Contract DAAB07-75-C-0146)
(AD-A020382; ECOM-75-0146-1) Avail: NTIS CSCL 17/2

The report describes development work to date on the transistorized RF Power Amplifier and Tuner Driver Assembly for the Receiver Transmitter RT-524 and RT-246. The calendar period covered for the material is 23 May to 15 Sep. 1975. During the reporting period, a breadboard power amplifier and tuner/driver were constructed and bench tested. Initial tests indicated that adequate power could be obtained from a single power amplifier transistor. The A6100 tuner assembly was successfully incorporated in the driver amplifier design. Data are presented on the output power, driver power, impedance measurements, output selectivity of the PA, regulator characteristics and power control characteristics. GRA

N76-29461# Army War Coll., Carlisle Barracks, Pa.
THE IMPLICATIONS OF A CONSOLIDATION OF MANAGEMENT, CONTROL AND OPERATION OF THE DEFENSE COMMUNICATIONS SYSTEMS
Robert J. Donahue 25 May 1975 114 p refs
(AD-A021475) Avail: NTIS CSCL 17/2

The study addresses the implications to the Department of Defense in (1) the assignment of Defense Communications System (DCS) operation and maintenance responsibilities to a single military department, or (2) the establishment of a Defense Communications Command. The parallel organization of the military departments and the Defense Communications Agency (DCA) indicated that significant improvements in organization structure, managerial functions and resource allocation would be achieved by either of the two alternatives. Elements of the analysis support the establishment of a Communications Command while other more powerful factors mitigate against a change from the existing system. The primary factor weighing heavily against the transition is the residual military department non-DCS/nontactical telecommunication functions. Regardless of the organization structure and relationships involved, telecommunication functions significant in both scope and purpose remain outside the DCS and must be accomplished. GRA

N76-29462# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LF TRANSMITTING ANTENNAS FOR A PROTECTED NULL ZONE APPLICATION
John L. Heckscher, Ralph J. McLain, Peter R. Franchi, and N. C. Gerson 21 Nov. 1975 49 p refs
(AF Proj. 4603)
(AD-A021471; AFCRL-TR-75-0595; AFCRL-IP-241) Avail: NTIS CSCL 17/2

The suitability of two candidate LF transmitting arrays for a specific point-to-point communication link is assessed subject to a null zone requirement. Critical parameters are identified, and calculations are made based on both given and estimated parameters. Limitations of available information are discussed, and approaches are suggested for obtaining additional experimental data. GRA

N76-29463# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE ARIES PROGRAM: A GENERAL OVERVIEW AND USER'S GUIDE
Michael E. Austin 10 Dec. 1975 133 p refs
(Contract F19628-76-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A020807; TN-1975-14; ESD-TR-75-237) Avail: NTIS CSCL 15/3

ARIES is a system simulation computer program developed

by Lincoln Laboratory to study radar tracking and command-guided intercepts in a realistic radar environment. The report is the first in a series of three, and provides a broad operational perspective on the ARIES Program while avoiding those mathematical details to be found in subsequent reports in the series. Model parameters and options available to the engineer are presented, together with sufficient program structure and control information to enable a programmer to execute the ARIES Program. GRA

N76-29464# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT DR8A TEST Interim Report, May - Oct. 1975
James Hamant, Edward F. New, and Joseph Phillips 31 Dec. 1975 39 p
(AD-A020316; CCC-CED-75-DTEP-010) Avail: NTIS CSCL 17/2

The Avantek DR8A radio was tested in back-to-back configuration to determine transfer parameters and to refine standard test techniques. The radio operates at a baseband rate of 12.5526 Mb/s (192 voice channels) in a 7 MHz bandwidth in the 8 GHz band. The modulation technique is quadrature phase partial response (QPR). BER vs RSL characteristics are displayed as the primary mode of equipment evaluation. Carrier-to-interference data and diversity switching error data are presented. The power spectrum is displayed showing 99% power bandwidth points and masks for the FCC emission limitations. The mean BER vs RSI curve is displayed approximately 4 db from the theoretical, with about a 3.5 db maximum variation among transmitter-receiver combinations. The 99% power bandwidth is 6 MHz, and application of the mask indicates compliance with the FCC digital limitations, after assumptions. C/I results show that the 18 db ratio is the lowest tolerable, with a mean BER plateau of 0.0001, at higher RSL'S. Receiver diversity switching results confirm errorless operation.
Author (GRA)

N76-29465# Rome Air Development Center, Griffiss AFB, N.Y.
PERFORMANCE OF SELECTED QUASI-ANALOG, SYNCHRONOUS AND NON-SYNCHRONOUS DATA TRANSMISSION SCHEMES ON NON-ERROR FREE DIGITAL TDM LINES Interim Report
Steven S. Russell and Guy E. Eller Jan. 1976 90 p refs
(AD-A021240; RADC-TR-75-322) Avail: NTIS CSCL 17/2

The report presents an analysis of three data transmission methods over a time division multiplexed communications link. The three methods are: quasi-analog data, synchronous data and non-synchronous data. The communications link is not ideal and is characterized by bit errors in the multiplexed data stream. The bit errors were injected synthetically and not by a real channel. The injection mechanism and error rate is not necessarily characteristic of any real channel. The purpose of this report is to observe how errors are demultiplexed and how these errors manifest themselves in the data transmitted to the user. A unique analysis capability shows the actual distribution of injected errors and the resultant error-free interval distribution of modems operating at three different data rates: 2,400, 4,800, and 9,600 Bps. GRA

N76-29466# Rome Air Development Center, Griffiss AFB, N.Y.
ADVANCED VLF/LF RECEIVE SYSTEM DEVELOPED UNDER THE TRI SERVICE PROPAGATION PROGRAM
Wayne Bonser Jan. 1976 68 p refs
(AD-A021233; RADC-TR-75-284) Avail: NTIS CSCL 17/2

The report describes the advances made in VLF/LF reception and analysis with the application of a computer-controlled narrowband receive system (HP 3040A). It also describes the techniques used and the difficulties encountered during the design and fabrication of an interface to interconnect a Hewlett-Packard (HP) Network Analyzer to a Data General Nova 1200 Minicomputer. The HP 3040A Network Analysis System was specifically designed to operate remotely with slower, more tolerant devices than a computer. The recommended remotely controlling devices are an HP 3260A Marked Card Programmer for input and a Teletypewriter for direct output. The software driver programs to direct the Nova/Analyzer interface and the new System's performance data are also discussed. GRA

N76-29467# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
PERFORMANCE OF DIGITAL MODEMS WITH COCHANNEL INTERFERENCE AND GAUSSIAN NOISE
John R. Juroshek Feb. 1967 63 p refs
(PB-251961/9; OTR-76-82) Avail: NTIS HC $4.50 CSCL 17B

An approximate method for estimating the performance of digital systems operating with cochannel interference and Gaussian additive noise is described. The method uses Monte-Carlo techniques and an approximation, based on the geometrical characterization of signals, to estimate the error rate of a variety of digital systems as a function of signal-to-noise ratio and signal-to-interference ratio. Curves are presented that show excellent agreement between the estimates and theoretical predictions at symbol and bit error rates as low as 10 to the minus 9 power. Computer programs are included that estimate error rate for multiphase coherent phase-shift keyed (CPSK), noncoherent frequency-shift keyed (NCFSK), differentially coherent phase-shift keyed (DCPSK), and coherent amplitude-phase-shift keyed (CAPK) systems. The programs can handle single as well as multiple cochannel interference, and examples are given that show error rate in both environments. Author (GRA)

N76-29468# Office of Telecommunications, Boulder, Colo. Analytical Support Div.
INTERNATIONAL TELECOMMUNICATIONS BIBLIOGRAPHY Special Publication, period ending Nov. 1975
Mary P. Fackelman and Kimberly A. Krekel Mar. 1976 173 p
(PB-251958/5; OT-SP-76-7) Avail: NTIS HC $6.75 CSCL 17B

The bibliography is a reference guide that cites and annotates over 400 articles on various aspects of telecommunications. Articles are relevant to U.S. policy in communications, and range from specific technologies and systems worldwide, to economics and industry structures. Chapters highlight the U.S. communications industry, telecommunication programs outside the U.S., international telecommunication organization, international trade, financial and technical cooperation, and international law includes author index, subject index. GRA

N76-29469# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
A DIGITAL TELECOMMUNICATION CONVERSION MODEL FOR ELECTRONIC MESSAGE MIXTURES
Peter M. McManamon Apr. 1975 127 p refs
(PB-252183/9; USPS-1702-110) Avail: NTIS HC $6.00 CSCL 17B

A mathematical model is developed to estimate the digital bits/message for message mixtures which arrive at a digital telecommunication network station for conversion to electronic messages and transmission. Digital data on tape or cards, and alphanumeric and graphic messages on paper, are assumed to be converted to digital bits by one of five conversion processes: digital data, character reader, black and white graphic binary or N-ary, or color graphics. The model allows parametric studies and incorporates the message size reductions from data compression technology. Results are given for the mean, standard deviation, and probability functions of the number of bits/message for 11 mixture cases for 3 different sets of data compression ratios. GRA

N76-29470# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MANUAL CONTROL IN TARGET TRACKING TASKS AS A FUNCTION OF CONTROL CHARACTERISTICS: A FLIGHT SIMULATOR INVESTIGATION, PHASE 2 Final Report, 15 Jul. 1974 - 15 Oct. 1975
Harold D. Warner, Thomas G. Drennen, and James G. Curtin 15 Jan. 1976 114 p refs
(Contract N00014-72-C-0264; NR Proj. 196-120)
(AD-A021729; MDC-E1433) Avail: NTIS CSCL 17/9

An investigation was conducted of fingertip control devices which were integrated into an aircraft throttle and used in a target acquisition and tracking task. The experimental variables included two types of controls (force and displacement), two control output functions (step and exponential), two cursor control calculation techniques (conventional and modified), and

three control display ratios. In the evaluation, 24 military-rated pilots performed an aircraft control task in addition to a target tracking task in a fixed base part task flight simulator. Pitch, roll, and airspeed errors were recorded to provide the objective measures of aircraft control proficiency. The objective measures of target tracking performance included target acquisition time and error, percent time on target, X and Y axis tracking error, and overshoots before target acquisition. GRA

N76-29471# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FREQUENCY SCAN ANTENNA DESIGN FOR RPV RADAR SENSORS
Francis G. Willwerth and Jerald A. Weiss 22 Oct. 1975 43 p refs
(Contract F19628-76-C-0002; ARPA Order 2752)
(AD-A021898; TT-5; ESD-TR-75-285) Avail: NTIS CSCL 17/9

A small program to explore the feasibility of a frequency-scanned antenna as a low-cost, light-weight answer to the requirements of the mini-RPV radar system for the HOWLS program resulted in construction and study of a slotted-waveguide laboratory embodiment of the device. A general formulation of the relationships connecting design parameters was carried out and employed for guidance in selection of waveguide size, band center, and slot spacing. A 30% band from 14.8 to 20.3 GHz in empty WR-42 waveguide was selected. The beamwidth, sidelobe level, gain, attenuation and efficiency were studied, including the effectiveness of tapered illumination and the occurrence of spurious cross-polarized radiation, as functions of the frequency-controlled scan direction. Some thought was given to alternatives such as aperiodic-array and subarray techniques as means of reducing the tunable bandwidth requirement, as well as stripline serpentine-waveguide designs, for possible future investigation. The work reported herein has shown that the frequency-scanned antenna will provide a low-cost implementation practical for some system applications. If the limitation, primarily in instantaneous signal bandwidth are acceptable in the applications pursued, further investigation of alternate designs is recommended. Author (GRA)

N76-29472# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ROBUST SPEECH PROCESSING
Bernard Gold 27 Jan. 1976 40 p refs
(Contract F19628-76-C-0002)
(AD-A021899; ESD-TR-76-32) Avail: NTIS CSCL 17/2

Relatively little effort has been expended toward designing low data rate speech processing devices which can operate in difficult environments. The particular problems addressed include that of good behavior for a wide variety of speakers, with tandeming and conferencing configurations, in the presence of jamming and/or background noise and with telephone speech as input. Author (GRA)

N76-29473# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A LESSONS-LEARNED STUDY OF AN AIRBORNE UHF RADIO PROGRAM M.S. Thesis
Kenneth A. Medlin Sep. 1975 128 p refs
(AD-A021264; GSM/SM/75S-6) Avail: NTIS CSCL 05/1

A study was made on the evolution of the major subsystem program. Of primary concern was the manner in which a program is initiated, the changes which it undergoes and the reason for the changes. The intent of the study was to extract lessons learned which might be of benefit to others in subsystem program management. The study was accomplished by reviewing program data and interviewing key participants. This data was reviewed through an hypothesized framework of initial attempts, regrouping, nature and direction, solicitation, evaluation and award of a subsystem program. This study has shown the difficulty in establishing a basis of action for a subsystem program, the subjective nature of requirements, the difficulty in building competition and openhandedness into a program, and the complexity of a program even when it is a subsystem. In addition, it was shown that the hypothesized framework was realistic in reviewing the evolution of a subsystem program.GRA

N76-29474# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETECTION AND FALSE ALARM PERFORMANCE OF A PHASE-CODED RADAR WITH POST-MTI LIMITING
Robert M. ODonnell 21 Nov. 1975 26 p refs
(Contract F19628-76-C-0002; AF Proj. E212)
(AD-A021334; TN-1975-62; ESD-TR-75-318) Avail: NTIS CSCL 17/9

The report studies the detection and false alarm performance of the generic type of radar which employs a phase-coded pulse compression and an MTI system followed by limiting. This technique has been referred to as CPACS (Coded Pulse Anti-Clutter System). One specific implementation of the technique was studied in detail. GRA

N76-29475# Mitre Corp., Bedford, Mass.
TDMA (TIME DIVISION MULTIPLE ACCESS) COMMUNICATIONS IN EUROPE, VOLUME 1 Final Report
R. E. Zapolin Jan. 1976 46 p
(Contract F19628-75-C-0001; AF Proj. 5170)
(AD-A021723; MTR-3034-Vol-1; ESD-TR-75-309-Vol-1) Avail: NTIS CSCL 17/2

In March and April 1975, a TDMA communications system distributed data during the E-3A demonstrations for senior NATO staff. Aircraft, boat, ship, and ground station position and status information were exchanged among the British LINESMAN, West German 412L, French STRIDA II, NATO NADGE and SHAPE, and the US 407L, HAWK and NTDS systems, with the proven benefits of TDMA information distribution. The TDMA network provided line-of-sight radio-range in excess of 350 miles, extended through an airborne relay, to link participating defense elements during all demonstrations. At the terminals less than 10% of the messages were received in error. System availability during the missions exceeded 99%. In the report, the scenarios and interfaces used are outlined. The demonstrated operational capabilities, high registration accuracies, and low-error-rate net performance are presented. GRA

N76-29476# National Oceanic and Atmospheric Administration, Rockville, Md.
ASYMPTOTIC THEORY OF THE DIFFRACTION OF ELECTROMAGNETIC WAVES
E. I. Nefedov and A. T. Fyalkovskii Jan. 1975 314 p refs
Transl. into ENGLISH of the book "Asimptoticheskaya Teoriya Difraktsii Elktromagnitnykh Voln na Konechnykh Strukturakh" Moscow, 1972 Sponsored in part by NSF
(TT-74-53110) Avail: NTIS HC $9.75 CSCL 20N

An explanation is given of the asymptotic theory of diffraction of electromagnetic and sound waves on limited bodies, dimensions of which considerably exceed the wavelength. Systematic explanation of the main method; of successive diffraction; integral equations; Haskind-Wainshtein method, etc. The bases are the Haskind-Wainshtein methods and that of successive diffractions, which have become widely applied during recent years in resolving problems of mathematical theory of diffraction. GRA

N76-29477# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
WCCM AUTOMATED TEST SYSTEM Final Report, 28 Feb. - 28 Sep. 1975
James W. Wheeler, Joan R. Nadeau, Dale L. Nickponski, and Jurgis A. Gedaugas Dec. 1975 326 p refs
(Contract F30602-75-C-0120; AF Proj. 5556)
(AD-A021741; RADC-TR-75-297) Avail: NTIS CSCL 17/2

The technical report describes in detail the modifications needed to update the manually-controlled WCCM Experimental Model hardware so that system control, data acquisition, reduction and parameter display for various scenarios can be accomplished by a minicomputer. The modular organization of the report into independent analysis hardware and software sections allows the software-oriented user to prepare detailed programs directly from the supplied flowcharts without being required to be familiar with hardware details or the rationale for a specific implementation. Conversely, the hardware-oriented user interested in isolating a malfunction is supplied with detailed information on the newly-added equipment and its interrelationship with the original WCCM configuration. The report consists of four main sections: WCCM Experimental Model Operational Summary; Hardware Definition; Software Definition; and Integration and Test. GRA

N76-29478# Rome Air Development Center, Griffiss AFB, N.Y.
LASER RADAR SIGNATURES OF RV MODELS OF INTEREST IN BALLISTIC MISSILE DEFENSE
James H. Michels, Eugene E. Bromley, and Fred J. Demma Feb. 1976 118 p refs Sponsored in part by the Army
(AD-A021631; RADC-TR-75-319) Avail: NTIS CSCL 15/3

A series of measurements were conducted on laser backscatter characteristics from modeled RV and decoy targets of interest to Ballistic Missile Defense (BMD). Bidirectional reflectance measurements were made on the various surface materials. The experimental results were compared with an in-house analytical model (BKSCAT) which predicts backscatter levels based upon flat plate bidirectional reflectance measurements. The agreement between the experimental and analytical results ranges from excellent to poor. Good agreement was obtained for targets from which representative flat plate reflectance data can be obtained. GRA

N76-29479# California Univ., Los Angeles. Dept. of System Sciences.
COMMUNICATION NETWORKS: DELAY-CAPACITY FUNCTIONS AND RELIABLE TOPOLOGICAL STRUCTURES
Izhak Rubin Nov. 1975 63 p refs
(Contract N00014-75-C-0609; Grant NSF ENG-75-03224)
(AD-A021439; UCLA-ENG-7595) Avail: NTIS CSCL 17/2

A store-and-forward communication network is considered. The network is represented as a linear graph with line capacity weights and Poisson terminal message streams. A maximal message-delay measure is chosen as the network's delay criterion. Considering the capacity assignment problem, the product of a prescribed network maximal message-delay and the associated minimal overall network capacity (bandwidth) is shown to be separated into the sum of two terms. The first term involves the overall internal traffic flow. The second one, called the Delay-Capacity product number, depends only on the routing discipline and the topological structure of the network, and yields the delay-capacity product for a reduced capacity-assignment problem. GRA

N76-29480# Dikewood Corp., Albuquerque, N.Mex.
PENETRATION OF ELECTROMAGNETIC FIELDS THROUGH SMALL APERTURES IN PLANAR SCREENS, SELECTED DATA Final Report
Donald R. Wilton and Chalmers M. Butler Aug. 1975 42 p refs Sponsored in part by DNA Prepared under subcontract by Mississippi Univ., University
(Contract F29601-74-C-0010)
(AD-A021491; DC-TN-7204-5; AFWL-TR-74-281) Avail: NTIS CSCL 20/14

Selected numerical data are presented for penetration of electromagnetic waves through apertures in planar screens. Major attention is focused upon electrically small, rectangular apertures, and for a specified length-to-width ratio, five numbers are given which enable one to compute equivalent electric and magnetic dipole moments due to an incident plane wave of any polarization, angle of incidence, and magnitude. Convergence of solutions is discussed as is the accuracy of equivalent dipole representations of fields which penetrate an aperture. GRA

N76-29481# R and D Associates, Marina Del Rey, Calif.
LINEAR AND NON-LINEAR EMP DIFFUSION THROUGH A FERROMAGNETIC CONDUCTING SLAB
William J. Karzas and Charles T. C. Mo Jul. 1975 79 p refs
(Contract N00014-75-C-0104; NR Proj. 321-046)
(AD-A021452; RDA-TR-9000-001) Avail: NTIS CSCL 20/14

The report investigates the shielding problem for the incident EMP in the form of a cylindrical TEM wave, such as a wire carrying a surge arrestor current terminated at an iron or steel shielding plane. Because of the large strength of the incident field, the nonlinear ferromagnetic saturation of the plate plays an important role in determining the peak and the shape of the shape of the transmitted field. This problem, based on and together with its one-dimensional plane-wave-incidence version, is solved analytically for a constant mu case. The analytical results are then used to partly predict and to interpret the numerical results for the one-dimension nonlinear case, obtained by using a finite difference code DIFUSN, and to help predict the behaviors for the cylindrical nonlinear case. GRA

N76-29482# White Sands Missile Range, N.Mex.
ASYMMETRICAL MULTISTATION EFFECTS ON GDOP IN TARGET TRACKING Final Report
B. D. Sivazlian and R. E. Green Dec. 1975 90 p refs
(DA Proj. 1U8-65804-DE-93)
(AD-A020338; STEWS-ID-75-2) Avail: NTIS CSCL 14/2

Accurate estimates of Cartesian coordinates of the existing range instrumentation systems depend on such factors as target position, number of instruments, location of instruments, and instrument accuracy. This report analyzes the problem of instrument location when the station configuration is asymmetrical. This is an extension of a previous investigation and covers a more general class of problems. This study has shown that, for angle measuring devices, the error estimate is functionally related to the azimuth reference used when the station locations are asymmetrical. Expressions are developed for several classes of site geometries. Optimal site geometries have been identified within a certain class of site geometries. Author (GRA)

N76-29483# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
ANALYSIS OF RADAR CROSS SECTION MEASUREMENTS OF A SCALE MODEL OF THE MQM-34D
James W. Wright 12 May 1975 50 p refs
(AD-A022015; RE-75-30) Avail: NTIS CSCL 17/9

Monostatic radar cross section (RCS) measurements of a half scale model of the MQM-34D target drone are reduced and analyzed for vertical principal circular, and cross circular polarizations. The vertically polarized measurements are also compared with RCS measurements of a full-scale drone. The RCS measurements are reduced on a cut-by-cut basis and on an aspect angle region basis. The former method is more conventional and provides insight into some details of the scattering. The second method is of interest for statistical comparisons of the different polarizations. Author (GRA)

N76-29484# Naval Research Lab., Washington, D.C.
ELF NONLINEAR NOISE PROCESSING EXPERIMENTAL MEASUREMENTS. PART 1: PRELIMINARY RESULTS FOR JULY AND OCTOBER 1975 Interim Report
William D. Meyers and John R. Davis Mar. 1976 14 p refs
(NRL Proj. R07-25)
(AD-A021975; NRL-R-3226-Pt-1) Avail: NTIS CSCL 17/2

A hybrid analog-digital signal processing method has been developed to investigate the potential of employing nonlinear noise processing to improve the signal-to-noise ratio (S/N) in extremely low-frequency (ELF) communication systems. Preliminary results suggest that significant improvements in S/N can be achieved if careful attention is given to clipping levels for high-amplitude atmospheric noise spikes and notch-filtering man-made interfering signals. Analysis of ELF noise data from Norway and Italy indicate, however, that the achievable improvemnt may be greater under low-noise conditions than under high-noise conditions. Author (GRA)

N76-29485# Army Electronics Command, Fort Monmouth, N.J.
AN ANTENNA FOR COMBINED SURVEILLANCE AND FOLIAGE PENETRATION RADAR: COMSFOR
John Borowick Mar. 1976 26 p
(DA Proj. 1S7-62703-DH-93)
(AD-A021976; ECOM-4395) Avail: NTIS CSCL 17/9

An antenna has been designed for the Combined Surveillance and Foliage Penetration Radar (COMSFOR) project. The antenna provides an existing X-band surveillance radar with a moderate foliage penetration capability. The foliage penetration antenna is an array of L-band, stripline dipole/director elements placed in front of an X-band aperture. A description of the dual-frequency antenna is given along with the measured RF performance at both frequency bands. A separate L-band corner reflector antenna design which can be mounted on a lightweight telescoping mast is also described. The antenna has demonstrated excellent gain and pattern characteristics for its size. Author (GRA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-29486*# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.

UNIVERSITY OF UTAH FOUR-CHANNEL PULSE-TO-PULSE COMMUTATED SUPER-LOKI ROCKET METEOROLOGICAL PARACHUTESONDE (ELECTRONICS)

K. W. Atwood and D. A. Soss Mar. 1976 35 p

(Contract NAS6-2627)

(NASA-CR-141410; UTEC-UA-76-160) Avail: NTIS HC $4.00 CSCL 09C

The electronics and temperature sensing units of the pulse-to-pulse rocketsonde are described. The sonde is designed for the 2 1/8-inch dart of the SUPER-LOKI meteorological rocket. In flight, the sonde descends by parachute from rocket apogees of about 75 kilometers. As the sonde descends, it transmits air temperature data back to ground radio receiving stations. Author

N76-29487# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

SURVEY OF GROUNDING, BONDING, AND SHIELDING PRACTICES Final Report, May 1974 - Dec. 1975

H. W. Denny and J. A. Woody Apr. 1976 76 p refs

(Contract DOT-FA72WA-2850)

(AD-A025244/5; FAA-RD-76-78) Avail: NTIS HC $5.00 CSCL 09/3

In May 1974 detailed surveys were made of the grounding, bonding, shielding, and lightning protection networks in FAA facilities at Hartsfield International Airport, Atlanta, GA and in selected AF facilities at Robins AFB, GA and Aiken AFS, Aiken, SC. At the facilities the earth electrode system, the lightning protection system, fault protection and signal ground networks, bonding practices, and facility shielding were evaluated. Similarly, the equipments in each facility were examined to determine the grounding procedures used for both low frequency and high frequency signals, the type of signal interfacing used, the bonding practices employed, and the type of shielding available for both personnel protection and EMI control. This report presents the findings of the surveys, compares the existing networks and practices with those which have been recommended for new facilities, and suggests corrective measures for the noted deficiencies. Author

N76-29488# Rome Air Development Center, Griffiss AFB, N.Y.

AN EVALUATION OF SILICON ON SAPPHIRE TECHNOLOGY Final Report, 1 Mar. 1975 - 1 Mar. 1976

Henry Domingos (Clarkson Coll. of Technol.) and Richard Anderson (Syracuse Univ.) 1 Apr. 1976 151 p refs Sponsored by FAA

(AD-A024907/8; FAA-RD-76-62) Avail: NTIS HC $6.75 CSCL 09/1

A description of this logic family is given, including such topics as manufacturing processes, device physics, and performance of commercial circuits. The report concludes with an overall evaluation of this technology. Author

N76-29489# National Aviation Facilities Experimental Center, Atlantic City, N.J.

TEST AND EVALUATION OF BROADBAND VHF ISOLATOR Interim Report, Jan. - Sep. 1975

James J. Coyle May 1976 12 p

(AD-A024477/2; FAA-NA-75-70) Avail: NTIS HC $3.50 CSCL 09/5

A prototype broadband VHF ferrite isolator device that can be used to reduce transmitter intermodulation in air traffic control air/ground communication equipments was described. The isolator was tested and was found to reduce T-1108/GRT-21 transmitter intermodulation approximately 30 db. Test results fell short of design goals for weight, insertion loss, and intermodulation product reduction. Author

N76-29490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROCESS FOR PREPARING LIQUID METAL ELECTRICAL CONTACT DEVICE Patent Application

Robert R. Lovell, Frank D. Berkopec, and David H. Culp, inventor (to NASA) Filed 26 Jul. 1976 12 p

(NASA-Case-LEW-11978-1; US-Patent-Appl-SN-708658) Avail: NTIS HC $3.50 CSCL 09A

The parts of an electrical contact device, such as a slip ring comprised of the ring to receive the liquid metal and the probe or brush for contacting the liquid metal, are treated by sputter etching to remove the parent metal oxide. Prior to exposure of the electrodes to any oxygen, a sacrificial metal is sputter deposited on the parts. Preferably this sacrificial metal is one that oxidizes slowly and is readily dissolved by the liquid metal. The sacrifical metal may then be removed from unwanted areas. The remainder of the ring and the probe are submerged in the liquid metal or the liquid metal is flushed over these areas, preferably while they are being slightly abraded, until all the sacrificial material on these portions is wet by the liquid metal. In doing so the liquid metal dissolves the sacrificial metal and permanently wets the parent metal. Preferred materials used in the process and for the electrodes of electrical contact devices are high purity (99.0 percent) nickel or AISI type 304 stainless steel for the electrical contact devices, gallium as the liquid metal, and gold as the sacrificial material. NASA

N76-29491*# Northeastern Univ., Boston, Mass.

TWO DIMENSIONAL THERMAL AND CHARGE MAPPING OF POWER THYRISTORS

Shih Pei Hu and Benjamin M. Rabinovici 4 Sep. 1975 145 p refs

(Contract NAS12-2053)

(NASA-CR-134635) Avail: NTIS HC $6.00 CSCL 09A

The two dimensional static and dynamic current density distributions within the junction of semiconductor power switching devices and in particular the thyristors were obtained. A method for mapping the thermal profile of the device junctions with fine resolution using an infrared beam and measuring the attenuation through the device as a function of temperature were developed. The results obtained are useful in the design and quality control of high power semiconductor switching devices. Author

N76-29492# California Univ., Livermore. Lawrence Livermore Lab.

CONSTRUCTION AND TESTING OF THE 2XIIB FLAT-TOPPING POWER SUPPLY

L. L. Refigato and B. H. Smith 5 Nov. 1975 4 p Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego

(Contract W-7405-eng-48)

(UCRL-77215; Conf-751125-20) Avail: NTIS HC $4.50

The construction details and test results of the 2XIIB flat topping modules are described. Both practical design and construction considerations as well as fabrication techniques are discussed. Power for the main compression coils of the 2XIIB is derived by discharging a high voltage capacitor bank and then crowbarring at the current peak to obtain L/R decay in the fields. To study plasma confinement under these quasi steady state conditions, it is necessary to hold the compression coil current constant for 10 ms. This is done by supplying only the I squared R losses of the system, using a low voltage bank. The low-voltage bank consists of 48 modules each supplying 20,000 A at plus or minus 450 V to each compression coil for a total of 480,000 A. The low voltage electrolytic bank is isolated from the high voltage bank by silicon diodes, which also act as crowbars at the end of the 10-ms flat topping or in the event that the electrolytic bank is not used. ERA

N76-29493# Oak Ridge National Lab., Tenn.

THEORY AND NUMERICAL CALCULATION OF THE ACOUSTIC FIELD EXERTED BY EDDY-CURRENT FORCES

K. Kawashima Jan. 1976 102 p refs

(Contract W-7405-eng-26)

(ORNL-5065) Avail: NTIS HC $6.50

The equations for calculating the acoustic field produced within a nonmagnetic metal by interaction of eddy currents with a static magnetic field were obtained on the assumptions that:

(1) an ultrasonic wave is generated by the electromagnetic force through classical and macroscopic phenomena; (2) the electric, magnetic, and elastic properties of the metal are linear, isotropic, and homogeneous throughout the metal, which occupies semi-infinite space; (3) the whole system is axially symmetric; and (4) eddy currents and elastic waves show a steady-state sinusoidal variation. Trasonic transducer with axial symmetry was calculated numerically, and the results showed a well-defined ultrasonic wave beam, which was narrower than had been expected from the size of the transducer. Author (ERA)

N76-29494# Stanford Univ., Calif. Electronics Lab.
NEW PHILOSOPHY FOR WIRE ROUTING
B. R. Rau Nov. 1975 42 p refs
(Contract AT(04-3)-326)
(SU-SEL-75-049; SU-326-P39-6; TR-101) Avail: NTIS HC $4.00

A number of interconnection algorithms exists and has been used quite successfully for printed circuits. However, most of them, though differing in detail, appear to subscribe to the same underlying philosophy which has developed from that for single layer printed circuit boards. Arguments are advanced which question the validity of this philosophy in the environment of multilayer board technology. A philosophy is developed that will be more suited for use with multilayer boards. Based on this philosophy, an interconnection algorithm is then developed in a step by step fashion. Author (ERA)

N76-29495# Bendix Corp., Kansas City, Kans.
LOW FREQUENCY SHIELDING OF AN EXPERIMENTAL MULTIWIRE CABLE
D. W. Stone Jan. 1976 28 p refs Revised
(Contract AT(29-1)613)
(BDX-613-1267-Rev) Avail: NTIS HC $4.00

Shielding tests were conducted on an experimental cable and on four types of magnetic-shielding materials. Some of the manufacturing techniques of this cable satisfy the design requirements of a security cable for the transfer of data between computer terminals. The electric and magnetic shielding characteristics of the cables were researched in relationship to the security requirements. The magnetic shielding efficiencies of the four different materials were measured for possible use in the design of a magnetic shield with characteristics superior to thin-walled steel conduit. Author (ERA)

N76-29496# RCA Corp., Burlington, Mass. Government Communications and Automated Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM AUTOMATED IMAGE DEVICE EVALUATOR (AIDE) Final Progress Report, 28 Dec. 1973 - 15 Dec. 1975
F. W. Ketler et al Dec. 1975 49 p
(Contract DAAB05-74-C-2524)
(AD-A021414) Avail: NTIS CSCL 13/8

The Automated Image Device Evaluator is a computer controlled test system capable of performing selected production acceptance tests on 25 mm second generation image intensifier tubes. The primary program objective was to establish techniques, procedures, and equipment required to automate testing of image devices. The report presents a technical and physical description of the Development Model equipment design and configuration. It also describes program highlights, and a Manufacturing Plan. GRA

N76-29497# Naval Surface Weapons Center, White Oak, Md.
A USEFUL FILTER FAMILY Final Report
Arthur D. Delagrange 20 Oct. 1975 21 p refs
(AD-A021423; NSWC/WOL/TR-75-170) Avail: NTIS CSCL 09/5

A simple, practical frequency filter family is described which has found use in a wide range of applications. Derivation, formulas, and performance are given. GRA

N76-29498# Varian Associates, Palo Alto, Calif.
BORON NITRIDE SEMICONDUCTOR FILMS Final Report, 15 Jul. 1974 - 15 Jul. 1975
T. O. Yep and S. B. Hyder Dec. 1975 39 p refs
(Contract N00014-75-C-0020; NR Proj. 243-011; RR0210203)
(AD-A020157) Avail: NTIS CSCL 09/1

Boron nitride was grown by reactive plasma deposition using the ammonia-diborane reaction. The crystalline growth on substrates of Si, pyrolytic graphite, compression-annealed pyrolytic graphite, compression annealed pyrolytic BN and diamond was investigated by electron microscopy. The effect of gas ratio and substrate temperature on growth rate was also investigated. Electrical measurements were taken and an effort was made to determine the drift velocity of carriers in thin films of BN. Author (GRA)

N76-29499# Mitre Corp., Bedford, Mass.
INTENSIFIED SILICON DIODE-ARRAY TARGET TV-CAMERA TUBE (EBSICON); DESCRIPTION AND MATHEMATICAL MODEL
K. F. Muller and G. O. Sauermann Jan. 1976 128 p refs
(Contract F19628-76-C-0001; Mitre Proj. 6290)
(AD-A020994; MTR-3073; ESD-TR-75-362) Avail: NTIS CSCL 09/1

In the document the mechanical configuration and the electrical operation of a low light level TV scanning image tube which incorporates high optical gain and image storage is described. The physical phenomena associated with these properties are described. From analytical descriptions of the phenomena, a mathematical model is developed. The computer program implementations of the model provide economical tools for overall system design considerations. These implementations of the model are flexible enough to encompass all sensor tube characteristics and their operating modes conceivable at this time. Where sufficiently accurate tube and operating parameters were available, comparisons of the model performance with experimental data showed very good quantitative agreement. GRA

N76-29500# Stanford Univ., Calif. Microwave Lab.
SURFACE WAVE PARAMETRIC PROCESSORS AND LONG DELAY LINES Final Report, 1 Apr. 1973 - 31 Oct. 1974
H. J. Shaw, S. L. Quilici, and C. M. Fortunko 8 Dec. 1975 164 p refs
(Contract DAAB07-75-C-0134; DA Proj. 7X2-63304-D-215)
(AD-A020983; ECOM-73-0134-F) Avail: NTIS CSCL 09/1

Design procedures for wrap-around, helical SAW delay lines of large time delay together with large bandwidth are developed. The frequency dependence of the various loss mechanisms, i.e., crystal loss, air loading loss, and diffraction loss, are studied. This includes an analytical treatment of diffraction loss in unguided SAW delay lines. Loss balancing procedures are developed, for designing interdigital transducers to equalize the frequency tilt due to frequency dependence of the loss factors and produce a level passband, and procedures for removing the residual passband curvature are developed. These are applied to graded, phase weighted interdigital transducers. Summaries are given of time delay and bandwidth values available in delay lines on BGO, for typical values of delay line parameters and dynamic range. Delay line designs are presented for time delays of 0.1, 0.5, and 1 millisecond time delay. Experimental delay lines for these time delay values are described, one having time delay of .91 milliseconds and bandwidth of 65 MHz, for a time bandwidth product of 60,000, with center frequency of 83 MHz. Author (GRA)

N76-29501# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
SILICON CONTROLLED RECTIFIER LARGE SIGNAL MODEL Final Report, 1 Oct. 1974 - 30 Jun. 1975
R. P. Webb, W. R. Callen, W. E. Sayle, and R. D. Jones Wright-Patterson AFB, Ohio AFAPL Oct. 1975 28 p
(Contract F33615-74-C-2039; AF Proj. 3145)
(AD-A020872; AFAPL-TR-75-89) Avail: NTIS CSCL 09/1

Experimental measurements and a computer model of the transient behavior of standard low and intermediate power SCR's are described. The forward current through the device is monitored as the gate is triggered, with an initially applied forward voltage. The anode current as a function of time has been measured for fixed gate pulse duration, with gate pulse amplitude as a parameter. A computer model, using exponential functions to describe the anode current as a function of time, has been developed and is compared with the experimental results. GRA

N76-29502# Texas Instruments, Inc., Dallas. Central Research Labs.

ACOUSTIC RIDGE WAVEGUIDE TECHNOLOGY Semiannual Technical Report, 30 Jun. - 31 Dec. 1975

Robert S. Wagers Jan. 1976 36 p

(Contract N00014-75-C-0317; ARPA Order 2827)

(AD-A020745; TI-08-76-05) Avail: NTIS CSCL 09/1

This report presents results obtained during the second six months of development of acoustic waveguides. A primary motivation for developing acoustic waveguides is to take advantage of the potential size reduction over current surface acoustic wave technology. Waveguide components represent the next step in microminiaturization of acoustic signal processing devices. Devices that may be developed include directional couplers, ring resonators, and serial memory. In addition, because of the high degree of spatial confinement of the acoustic energy, nonlinear and acousto-optic interactions become possible. The technical problems associated with this research are threefold: (1) development of suitable etching processes for waveguide formation, (2) development of fine geometry stencils for transducer fabrication, and (3) development of transducer weighting characteristics for bandpass shaping. Author (GRA)

N76-29503# Army Foreign Science and Technology Center, Charlottesville, Va.

SEMICONDUCTOR DEVICES AND THEIR APPLICATIONS

Ya. A. Fedotova Oct. 1975 338 p refs Transl. into ENGLISH from Poluprov. Pribory i ikh Primenenie: Sb. Statei, (USSR), no. 32, 1970

(AD-A021625; FSTC-HT-23-109-75) Avail: NTIS CSCL 09/1

Contents: Methods of determination of parameters of semiconductors and semiconductor films in the SHF band; High-Q SHF diodes; Semiconductor diodes for frequency multiplication; Superhigh factor frequency multipliers; Planar-epitaxial SHF band varactors; Varactor frequency multipliers based on strip transmission lines for semiconductor SHF amplifier-multiplier circuits; Calculation of the operating mode of a varactor in a parallel frequency multiplier circuit; Recovery time of a limiter diode and methods of its determinations; The setting time of a limiter diode; Certain parameters of planar semiconductor SHF band diodes; Experimental study of frequency multipliers based on semiconductor diodes in the 18-70 GHz range; Selection of the working mode of a semiconductor AFC mixer for a radar receiver; Measurement of S parameters of SHF transistors; Varistors. GRA

N76-29504# Harry Diamond Labs., Adelphi, Md.

CAPACITOR FAILURE DUE TO HIGH-LEVEL ELECTRICAL TRANSIENTS

Charles Chase and Joseph Miletta Dec. 1975 22 p ref

(HDL Proj. E092E6; DNA Proj. NWER-EB-097)

(AD-A020532; HDL-TM-75-25) Avail: NTIS CSCL 09/1

The assumption that semiconductors are the most EMP-sensitive components in electronic circuits may not be universally correct. Recent tests conducted on solid tantalum capacitors of low dc voltage rating have demonstrated energy failure levels for solid tantalum capacitors comparable to the failure levels of low-power discrete semiconductor devices and small-scale integrated circuits. This report presents the results of these tests and describes the failure characteristics of the solid tantalum devices and other typical capacitor types. The tests covered the range of pulse widths from 1 to 3 microsec and produced failures in the range from 0.000060 joules to 0.05 joules, depending on the component type. These capacitor failure levels are compared to typical failure levels of semiconductor devices. Author (GRA)

N76-29505# Harry Diamond Labs., Adelphi, Md.

THE APPLICATION OF ELECTRETS TO CONDENSER MICROPHONES

Charles L. Coleman Dec. 1975 19 p

(DA Proj. 1T0-61101-A-91A; HDL Proj. A10410)

(AD-A020189; HDL-TM-75-24) Avail: NTIS CSCL 09/1

The disadvantage of conventional condenser microphones is the requirement of an external bias and the noise introduced by that supply. A series of experiments involved the use of the electret principle as a bias for condenser microphones. The experiments covered the dielectric material, fabrication of the microphone, and establishment and measurement of the electret voltages. GRA

N76-29506# Hughes Aircraft Co., Torrance, Calif.

MILLIMETER DUAL HELIX TRAVELING-WAVE TUBE Triannual Report No. 1, Jul. - Oct. 1975

A. E. Manoly Mar. 1976 25 p

(Contract DAAB07-75-C-1368; DA Proj. 1S7-62705-AH-94)

(AD-A022320; W-06596; ECOM-75-1368-1) Avail: NTIS CSCL 09/1

The program objective is to develop a TWT in which dual coupled helix slow-wave circuits interact with dual beams. The TWT is to be capable of amplifying high pulsed RF power over wide bandwidths with sufficient gain and efficiency suitable for electronic warfare applications. The circuit design with dual helices coupled by connecting straps, which was developed on previous contracts, shall be utilized for obtaining the performance requirements. During the first contract, effort was directed toward study of the circuit structure and a theoretical study of both single beam and dual beam electron guns. Circuit structures consisting of countrawound helices were investigated. Impedance, phase velocity and dielectric loading factor have been measured for various circuit structures, including adjacent helices as well as individual helices separated by different sized connecting straps. Based on the theoretical gun investigations, two scaled experimental electron guns were designed and evaluated using an electrostatic demountable beam analyzer. Two C-band tubes were packaged, tested and evaluated at various modes of operation. GRA

N76-29507# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering.

SYSTEM MODELING BASED ON STEADY STATE FREQUENCY RESPONSE MEASUREMENTS Final Report, 1 Jul. 1974 - 30 Jun. 1975

Wilson J. Rugh and Stephen L. Baumgartner Wright-Patterson AFB, Ohio AFFDL Jan. 1976 144 p refs

(Contract F33615-75-C-1001; AF Proj. 7071)

(AD-A022325; AFFDL-TR-75-127) Avail: NTIS CSCL 09/5

The structure of the identification problem for linear systems from sinusoidal input, steady-state response measurements is treated from an interpolation point of view. Both the cases of amplitude plus phase, and amplitude only measurements are discussed. It is shown that if sufficient amplitude measurements are made, then fewer phase measurements are required for identification. These results are extended to the identification problem for a class of nonlinear systems. It is shown that measurement of the amplitude plus phase of each harmonic of the steady-state response for a number of sinusoidal inputs can yield complete identification of the system. For the case of amplitude measurements only, it is shown that the ambiguity in identification is similar in nature to the linear case, and is easily characterized. Author (GRA)

N76-29508# University of South Florida, Tampa. Dept. of Electrical Engineering.

A COMPUTER MODEL FOR A HIGH POWER SCR Final Report, 1 Oct. 1974 - 30 Jun. 1975

H. A. Nienhaus, J. C. Bowers, and M. S. Ziemacki Dec. 1975 62 p

(Contract F33615-74-C-2039; AF Proj. 3145)

(AD-A022375; AFAPL-TR-75-106) Avail: NTIS CSCL 09/5

This paper describes a computer model for the Westinghouse T527-1284 series of SCR's. This device, which has an average continuous current rating of 115a and a one cycle surge current rating of 1,200a, consists of two SCR's in the amplifying gate configuration. The described model can also be applied to other devices which employ the amplifying gate and shorted emitter. Author (GRA)

N76-29509# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.

RESEARCH ON FAULT ANALYSIS OF ANALOG CIRCUITS Interim Report

S. D. Bedrosian and De Yuan Ho Jan. 1976 26 p refs

(Contract N00014-75-C-0768)

(AD-A021573) Avail: NTIS CSCL 09/5

Initial studies of this research program directed at developing

inexpensive alternative approaches for fault analysis of analog circuits are outlined. Specific topics show a basis for application of fuzzy set concepts, new portioning approaches based on chromatic and rook polynomial representation of graphs. GRA

N76-29510# Westinghouse Research Labs., Pittsburgh, Pa.
EXPERIMENTAL RESEARCH ON FABRICATION OF INTERDIGITAL TRANSDUCERS FOR ACOUSTIC SURFACE WAVES Final Report, 1 Jun. 1973 - 1 Dec. 1974
P. R. Malmberg, T. W. Keefe, M. M. Sopira, and H. K. Liang 19 Aug. 1975 72 p refs
(Contract F19628-73-C-00273; AF Proj. 5635)
(AD-A021482; AFCRL-TR-75-0455) Avail: NTIS CSCL 09/1

The objective of the program was to fabricate a variety of surface wave transducers on various substrates, using a digitally-controlled electron beam to expose the transducer patterns. Transducers were fabricated on lithium tantalate and lithium niobate substrates with finger and space widths varying from 1.6 to 0.6 micrometers, finger lengths from 240 to 400 micrometers, and number of fingers from 8 to 27 per transducer. An overlapping line segment technique was used along with multi-exposures to obtain line smoothness better than 0.04 micrometers. An exposure control with uniform 2.2% gradations was designed and used to obtain specified line widths. Vibration isolation and ambient magnetic noise cancellation permitted electron beam exposures of device patterns to be made in a relatively noisy environment. GRA

N76-29511# Air Force Systems Command, Wright-Patterson AFB, Ohio.
LARGE OUTPUT MILLIMICROSECOND IMPULSE GENERATOR USING ELECTROMAGNETIC SHOCK WAVES
J. Oravec, P. Gabco, and F. Virsik 22 Dec. 1975 13 p Transl. into ENGLISH from Elektrotech. Cas. (Czechoslovakia), vol. 24, no. 5 1973 p 341-347
(AD-A020152; FTD-ID(RS)I-2207-75) Avail: NTIS CSCL 14/2

The results illustrate the fact that excitation of electromagnetic shock waves can achieve velocities on the order of 1 million V/microsecond. There are real assumptions that optimization of the generator developed in the project will achieve velocities formed by impulses on the order of 10 million V/microsecond. Realization of the generator described solved a number of problems based on maximum suppression of parametric parameters of the ferrite conductor and generator as a whole, in developing the method of coaxial division intended for the formation of extended impulses with great velocity of ascending and descending edges, in the realization of a special coaxial system of voltage dividers for visual tracking of impulses generated by means of a rapid synchroscope, and in the guarantee of high electrical stability of the ferrite conductor. Author

N76-29512# Naval Postgraduate School, Monterey, Calif.
MICROSTRIP LOSS M.S. Thesis
Remzi Arikonmaz Dec. 1975 74 p refs
(AD-A021789) Avail: NTIS CSCL 09/1

The thesis presents a frequency dependent analysis of microstrip loss. Spectral domain theory is employed to develop expressions for both dielectric and conductor loss in a form suitable for programming on a digital computer. Computational results are presented and compared with those of other investigators. GRA

N76-29513# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF THE RESPONSE OF DIGITAL DEMODULATORS TO FREQUENCY SHIFT KEYED SIGNALS M.S. Thesis
Myron Wasiuta Dec. 1975 78 p refs
(AD-A021822; NPS-52W75121) Avail: NTIS CSCL 09/5

The theory and operational characteristics of a digital pulse counting frequency demodulator are presented. The demodulator, called the pulse width demodulator (PWD) in this report, is realized with solid state components and uses pulse circuitry to perform demodulation. The output of the demodulator may be applied to a low pass filter (LPF) to recover the modulating voltage. The PWD possesses the following properties: (1) wideband operation, (2) no tuning requirement, (3) simple resistor adjustment for selecting the operating frequency range, and (4) ability to operate at frequencies beyond the design range due to the circuit's ability to automatically frequency divide. The demodulator performance for analog and digital (FSK) modulating voltages is obtained at both commercial intermediate frequencies of 455 kHz and 10.7 MHz. Its performance in the presence of noise is investigated and compared to theoretical results for non-coherent FSK systems. GRA

N76-29514# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR BEAM LEAD SEALED JUNCTION SEMICONDUCTOR DEVICES Quarterly Progress Report, 21 May - 21 Aug. 1975
Art Peltier, Mike Crabtree, and Dan Zobel Aug. 1975 52 p refs
(Contract DAAB07-75-C-0033; DA Proj. 2759753)
(AD-A021322; QPR-1) Avail: NTIS CSCL 09/5

The accomplishments of the first quarter in Motorola's effort on the USA ECOM Manufacturing Methods and Technology beam lead device program are presented herein. Much effort has been expended in evaluating each device to determine the best approach for meeting the yield and production goals of the program. On many devices this effort is completed and reported in detail. Other devices are presented in outline form because the evaluation is not complete enough for full reporting, even though much time and effort is being expended on them.Author

N76-29515# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.
MANUFACTURING METHODS AND TECHNIQUES FOR PIEZOELECTRIC TRANSFORMERS Quarterly Progress Report, 14 Jul. - 14 Oct. 1975
William B. Harrison, L. Hiltner, W. Kammeyer, R. Kyle, J. Lingle, T. Rudy, and F. Swanson 14 Oct. 1975 87 p refs
(Contract DAAB07-76-C-0008)
(AD-A021329; QPR-1) Avail: NTIS CSCL 09/1

This section discusses our approach to both the 18mm and 25mm PET designs, and the advantages of this approach, along with an analytical approach used to determine performance of these transformers and the effect of various material and dimensional variations on their operational characteristics. The use of piezoelectric materials for the electrical to mechanical to electrical transfer of energy between two electrical circuits was proposed by Cady as early as 1928, but this concept did not receive significant attention until piezoelectric ceramic barium titanate was developed about 20 years later. Rosen was granted a patent in 1958 on a barium titanate piezoelectric transformer (PET). An analysis of a PET was carried out by Katz, who limited his discussions to barium titanate. The advent of many types of lead zirconate-lead titanate (PZ-PT) ceramics in 1955-1961 brought forward a new family of materials that had greater high temperature stability and power handling capability. New designs have been proposed, which are now being adopted as power supplies for many practical considerations. GRA

N76-29516# Raytheon Co., Waltham, Mass. Special Microwave Devices.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING HIGH EFFICIENCY, HIGH POWER GALLIUM ARSENIDE READ-TYPE IMPATT DIODES Quarterly Report, 30 Jun. - 30 Sep. 1975
H. R. Chalifour and S. R. Steele Oct. 1975 113 p
(Contract DAAB07-75-C-0045)
(AD-A021730; Rept-1075-1149; QR-1) Avail: NTIS CSCL 09/1

The growth of epitaxial wafers was begun; some of the wafers being grown for diode fabrication activities and others for use in the study of uniformity and reproducibility of characteristics. Work on wafer characterization techniques and other engineering tasks was begun. Preliminary wafer quality has been good. The yield of good diodes on a wafer has been high. Variation of device characteristics on a wafer has been excessive, however, as is demonstrated by the V sub B and V^* data presented. Specifications for the Ku-band diode must be redefined to achieve the proper operating frequency. Scheduled activity in the diode fabrication area included the initial processing of Read wafers

by production personnel in accordance with the appropriate process flow chart. GRA

N76-29517# Illinois Univ., Urbana. Coordinated Science Lab.
COMPUTER-AIDED ANALYSIS OF MIXER CIRCUITS
William Hsia Kao Jan. 1976 108 p refs
(Contract DAAB07-72-C-0259; Grant NSF ENG-75-02708)
(AD-A021720; UILU-ENG-76-2204; R-716) Avail: NTIS CSCL 09/5

While great advances have been made in numerical algorithms for d.c., a.c., and transient analysis of systems, very little research has been done on the development of simulation programs for the steady state analysis of nonlinear communication circuits. This thesis carries out an assessment of computer aided simulation techniques in the analysis of mixer circuits. Problems that are frequently encountered in mixer circuits, some mixer performance criteria, and some design tips are discussed. A survey of various computational techniques for the steady state analysis of nonlinear circuits is also presented. Author (GRA)

N76-29518# RCA Government and Commercial Systems, Camden, N.J.
RADIATION-HARDENED CMOS/SOS STANDARD CELL CIRCUITS Quarterly Report no. 3, 4 Aug. - 3 Nov. 1975
R. L. Pryor and A. Feller Dec. 1975 15 p
(Contract N00014-75-C-0709; DNA Proj. NWED-QAXTD033)
(AD-A021738; ATL-CR-75-14; QR-3) Avail: NTIS CSCL 09/5

Two versions of the radiation-hardened CMOS/SOS standard cell test chip were fabricated during this quarter. One set of test chips was processed using the CMOS/SOS process with the standard oxide. The objective of these chips is to provide verification of the design and layout of the family of standard cell circuits, all of which are used in the 8-bit multiplexed adder chip. The second set of test chips, using the same set of masks, was fabricated with the radiation-hard process using the clean, dry oxide. Twenty of the test chips were received and tested. All of the cell types were checked and operated normally. The design and layout of the 8-bit multiplexed adder chip were completed and triple-checked. The 80X artwork was generated. The adder artwork was not submitted to the mask fabrication cycle pending the results of the measurements on the standard oxide test chips. Now that these tests have been made and the correct functionality of all of the cell types validated, the adder artwork can now proceed through the mask and fabrication cycle. GRA

N76-29519# Piezo Technology, Inc., Orlando, Fla.
VHF MONOLITHIC FILTERS Final Report, 15 Sep. 1972 - Dec. 1975
R. C. Smythe Feb. 1976 81 p refs
(Contract DAAB07-72-C-0025; DA Proj. 1S7-62705-H-94)
(AD-A021739; ECOM-72-0025-F) Avail: NTIS CSCL 09/5

Six-pole tandem monolithic filters with a 6 db bandwidth of 40 kHz were fabricated at 150 MHz using third overtone plates. Both non-linear resonance and intermodulation phenomena were studied in some detail. Theoretical power handling limitations were established. The linear theory of thickness-shear resonators was modified to include overtones of thickness-shear and further extended to include rectangular electrodes. From these results, improved design techniques for filter crystals and monolithic filters are directly obtainable. GRA

N76-29520# Allis-Chalmers Corp., Pittsburgh, Pa. Overhead Distribution Transformer Div.
DISTRIBUTION TRANSFORMER TANK PRESSURE STUDY Final Report
E. A. Goodman Feb. 1976 528 p refs Sponsored by Elec. Power Res. Inst.
(PB-251259/8; EPRI-325-A) Avail: NTIS HC $13.00 CSCL 09A

Calculated static pressures are given which may occur within faulted oil filled distribution transformers as a result of arcing and gas generation. Tables of calculated pressures for a wide range of transformer air spaces, a selection of pressure relief devices, and a wide range and variety of circuit protecting fuses are included. In each case the calculation of pressure covers a full range of fault currents, the basic unknown variable. GRA

N76-29521# USCC/CENTRALAB, Los Angeles, Calif.
MANUFACTURING METHODS AND TECHNOLOGY PROJECT TO ESTABLISH AND IMPROVE THE PRODUCIBILITY OF SILK SCREENING AND LAYERING OF CERAMIC DIELECTRIC CAPACITORS Quarterly Progress Report, Oct. 1975 - 1 Jan. 1976
Jack Floegel 1 Jan. 1976 26 p refs
(Contract DAAB07-75-C-0041)
(AD-A021430; Rept-76-01-02) Avail: NTIS CSCL 09/1

The chip capacitors are to be manufactured using .0005 inch dielectric rated at 50 volts at a production rate of 5000 units per day. Internal electrodes shall be of a basemetal or alloy that will provide for an objective of 80% cost reduction from the use of palladium. End terminations shall be of the same material and must be capable of immersion for 30 seconds at 5000F in 60/40 solder. GRA

N76-29522# Illinois Univ., Urbana. Coordinated Science Lab.
REDUCTION OF DEPTH OF BOOLEAN NETWORKS WITH A FAN-IN CONSTRAINT
F. P. Preparata, D. E. Muller, and A. B. Barak Dec. 1975 29 p refs
(Contract DAAB07-72-C-0259)
(AD-A021662; R-712; UILU-ENG-75-2248) Avail: NTIS CSCL 09/5

In this paper a family of techniques for the design of combinational networks whose objective is the reduction of the number of levels, subject to a constraint on the fan-in of the logic gates is presented. GRA

N76-29523# Hughes Aircraft Co., Carlsbad, Calif. Industrial Products Div.
STORAGE CAMERA TUBE WITH NON-DESTRUCTIVE READOUT Interim Report, 15 Feb. - 13 Jun. 1975
L. S. Yagoy Jan. 1976 14 p
(Contract DAAB07-75-C-1305; DA Proj. 1S7-62705-AH-94D2)
(AD-A021432; ECOM-75-1305-1; IR-1) Avail: NTIS CSCL 09/1

The effort is aimed primarily at increasing the quantum efficiency at 1.06 micrometers beyond the 6 1/2% already achieved and, at the same time, realizing the resolution goal of 900 TV-lines per raster-height. Design and tooling phases have been completed for a new tube which has a larger target consistent with the goals as defined in the revised guidelines BD-2A. GRA

N76-29524# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
ALTERNATOR MODELING. PART 2: MODAL ANALYSIS TECHNIQUES APPLIED TO SYNCHRONOUS GENERATOR MODELING AND SIMULATION Final Report, Jul. 1974 - Jul. 1975
R. J. Kuhler Oct. 1975 26 p refs
(Contract F33615-74-C-2039; AF Proj. 3145)
(AD-A022374; AFAPL-TR-75-87-Pt-2) Avail: NTIS CSCL 09/3

The parameters of a linearized 3-phase synchronous generator are matched by measurement and modal analysis techniques with the experimental response of the actual machine. The method of parameter variation and limitations on these variations are defined. Author (GRA)

N76-29525# Dikewood Corp., Albuquerque, N.Mex.
EXCITATION OF A TERMINATED TEM TRANSMISSION LINE THROUGH A SMALL APERTURE Final Report
Darko Kajfez Aug. 1975 73 p refs Sponsored in part by DNA Prepared under subcontract by Mississippi Univ., University
(Contract F29601-74-C-0010)
(AD-A021488; DC-TN-7204-4; AFWL-TR-74-195) Avail: NTIS CSCL 20/14

The coupling of the energy from an incident plane wave to a transmission line situated behind a plane screen is computed by the use of equivalent electric and magnetic dipole moments. The frequency and time responses of the voltage at the transmission-line terminals are evaluated from the equivalent circuit consisting of one voltage generator and one current generator. It was found that the circular hole and a single-wire

transmission line have directional property when a TM incident wave is arriving in parallel with the screen surface. GRA

N76-29526# RCA Corp., Princeton, N.J.
SPECIAL EBS DEVICES Final Report, 1 Apr. - 1 Sep. 1975
Ho-Chung Huang, Wieslaw W. Siekanowicz, Stuart T. Jolly, Angela San Paolo, and Walter M. Janton Feb. 1976 22 p
(Contract DAAB07-75-C-1319; DA Proj. 1S7-62705-AH-94) (AD-A021493; PRRL-76-CR-2; ECOM-75-1319-F) Avail: NTIS CSCL 09/1

This Final Report describes the fabrication and testing of five GaAs Schottky-barrier EBS tubes. To improve the Schottky-Barrier characteristics and the reliability of the EBS diode, we have used platinum as the barrier metal rather than chromium. To reduce the electrical resistance, a chromium layer was deposited on top of the platinum layer. Both theoretical calculations and experimental results indicate that a Schottky-barrier metallization system consisting of 100-A Pt plus 300-A Cr is nearly optimum for EBS-application. Special EBS tubes employing GaAs platinum Schottky-barrier diodes with integral beam shield were successfully fabricated, evaluated, and delivered to the contracting agency. Author (GRA)

N76-29527# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
ANALYSIS AND EXPERIMENT ON AN ELECTRICAL TO FLUIDIC INTERFACE WITH NO MOVING PARTS
Paul L. Jacobs and J. C. Dunaway 7 Jan. 1976 49 p
(DA Proj. 1T1-62114-AH-73)
(AD-A022011; RG-76-40) Avail: NTIS CSCL 09/3

This report contains the results of experimental performance evaluation on an electrical to fluidic interface device with no moving parts. Scale factors, frequency response, null shift, power consumption, linearity, and signal-to-noise ratio were measured before and after a 10,000 'g' gun firing. It was concluded that the device has too low a frequency response for most control applications, and had an unacceptable null shift after the gun firing. The reason for the shift could not be determined because disassembly would destroy the device. A simplified analysis was performed to determine wire burnout tendency, heat transfer rates, and wire transient response. Expressions were derived which would enable tradeoff design studies to be performed for device improvement. Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-29528 Brown Univ., Providence, R.I.
HIGHER-ORDER EFFECTS IN TRANSONIC AND SUPERSONIC GASDYNAMICS Ph.D. Thesis
Chien Huo 1975 123 p
Avail: Univ. Microfilms Order No. 76-15644

Steady transonic and supersonic flows governed by the Navier-Stokes equations are considered. Using perturbation theory to describe transonic flows, the standard method of multiple scales is found impotent in dealing with the secularities. It is shown that transonic flow is essentially a two-mode theory. Among a number of results, the surface pressure in transonic flows is found in close agreement with the result by Spreiter and Alksne (1958). Higher approximations in supersonic flows are investigated by one-mode theory. Whitham's theory is derived and can be reduced, valid to the second order, by algebraic manipulations. A uniformly valid second-order theory is presented and a third-order theory is considered. Finally, supersonic flows past a number of families of semi-infinite bodies are considered. Dissert. Abstr.

N76-29529 California Univ., Berkeley.
SOME VELOCITY CHANGES ON ERGODIC FLOWS AND A SKEW PRODUCT OF A POISSON FLOW AND A BERNOULLI SHIFT Ph.D. Thesis
Delvis Alejandro Fernandez Levy 1975 77 p
Avail: Univ. Microfilms Order No. 76-15174

Induced flows are defined on sets of positive measure of a Lebesque probability space, and it is proved that isomorphic flows induce isomorphic flows. Results of N. Friedman are extended, showing that the class of sets on which a Bernoulli flow induces a Bernoulli flow is dense, and a formula for the entropy of an induced flow is obtained. It is shown that the Ornstein-Shields K-automorphisms can be imbedded in a K-flow which is not Bernoulli. Thus obtaining the result that it is possible to change the velocity of these flows so that the resulting flows are not Bernoulli. It is shown that a certain skew product of a Poisson flow and a Bernoulli two-shift yields a Bernoulli flow. A special representation theorem is obtained for ergodic flows with invariant sub-sigma-algebras. It is shown that such flows can be represented over functions which are constant over the fibers of the invariant sub-sigma-algebra restricted to the base space. Dissert. Abstr.

N76-29530 Missouri Univ., Rolla.
SPLIT-FILM ANEMOMETRY IN A DRAG-REDUCING SOLUTION Ph.D. Thesis
Jack Chosnek 1975 140 p
Avail: Univ. Microfilms Order No. 76-14614

Turbulence measurements were made in the tube flow of mineral oil and a 0.2% solution of polyisobutylene in the same oil. Velocity profiles, axial and radial turbulence intensities, and axial and radial energy spectra were obtained in both fluids using a split-film anemometer probe. In addition, velocity profiles and axial turbulence intensities were obtained in oil using a 0.001-in. cylinder probe, a cone probe and a parabolic-wedge probe. The measurements were made in a one-inch tube at a constant fluid temperature of 30.0C, in the Reynolds-number range of 4,800 to 50,000. Four factors influenced the results in a greater manner than previously thought or reported. These were: calibration, intermittent contamination of the probes, eddy shedding from cylindrical probes and electrical ground loops. Errors resulting from underestimating the importance of these factors could account for the discrepancies and large scatter of data existing throughout the literature of turbulence measurements. Dissert. Abstr.

N76-29531 Brigham Young Univ., Provo, Utah.
STEADY-STATE FLUIDICS: COMPUTER-AIDED ANALYSIS OF ANALOG FLUIDIC CIRCUITS BY USE OF EXPERIMENTALLY DETERMINED CHARACTERISTIC CURVES Ph.D. Thesis
Raymond Paul Martin, Jr. 1976 171 p
Avail: Univ Microfilms Order No. 76-16303

Performance of fluidic circuits can be predicted by using fluidic device characteristic curves to determine fluid amplifier operating points. Fluidic nonlinearities are handled by piecewise linear approximations of the experimentally determined input and output characteristics of fluidic devices. Synthesis and use of the computer aided analysis system have involved: (1) development of the FLUIDK computer program to permit rapid, convenient determination of the transfer characteristic of fluidic devices and circuits; (2) initial recommendations for improved tests to determine characteristics to represent fluid amplifiers; (3) inclusion of provisions to facilitate the required development of scaling techniques; and (4) identification of secondary influences which can adversely affect fluidic performance predictability. Dissert. Abstr.

N76-29532 Minnesota Univ., Minneapolis.
FLOW AND HEAT-TRANSFER CHARACTERISTICS FOR A TWO-DIMENSIONAL JET IMPINGING ON A CIRCULAR CYLINDER Ph.D. Thesis
Hiromichi Miyazaki 1975 110 p
Avail: Univ. Microfilms Order No. 76-14939

A closed-form solution was obtained for the potential flow about a circular cylinder situated in the impinging jet. The potential flow solution yields the main-stream velocity for the boundary layer adjacent to the cylinder surface. Results are presented for

the velocity and pressure distributions on the cylinder surface, for the position of the free streamline, and for the velocity gradients at the stagnation point. The laminar flow and heat-transfer characteristics for the wall-jet region located downstream of the stagnation region are investigated by making use of the method of inner and outer expansions. The Coanda effect, whereby an induced transverse pressure difference inhibits flow separation, was demonstrated by the analysis. A model of the momentum eddy diffusivity due to mainstream turbulence was constructed on the basis of measured turbulent velocity fluctuations. The thermal eddy diffusivity was obtained by the introduction of the turbulent Prandtl number. The present theoretical results were compared with available heat transfer data and other theoretical predictions. Dissert. Abstr.

N76-29533 Texas Univ., Austin.
THE ACOUSTIC PROPERTIES OF AN ORIFICE UNDER A TURBULENT BOUNDARY LAYER Ph.D. Thesis
Allen Lewis Goldman 1975 87 p
Avail: Univ. Microfilms Order No. 76-14456

The acoustic impedance of an orifice was measured in still air and in a wind tunnel where the orifice was subjected to a turbulent boundary layer. Tests were carried out at four frequencies -- 250, 500, 800, and 2,200 Hz; and at five wind tunnel velocities -- 16, 19, 23, 26, and 30 m/s. For the 250 Hz tests, both linear and nonlinear orifice behavior was investigated. It was observed that usually with flow the resistance increases over the no-flow resistance. And as the flow velocity increases the resistance increases. At the same time, the reactance with flow present is less than the no flow reactance, and decreases as the flow velocity increases. However, cases were observed where resistance decreased and reactance increased with increasing flow velocities. The results of a dimensional analysis of the data are discussed. Dissert. Abstr.

N76-29534 Texas Univ., Austin.
ON THE MECHANICS OF NON-NEWTONIAN FILMS Ph.D. Thesis
John Wesley Gardner 1975 197 p
Avail: Univ. Microfilms Order No. 76-14451

The kinematical foundations are laid for the study of films (collections of surface active molecules at fluid-fluid interfaces) having a memory. Finite surface strain tensors are defined. The concepts of steady shearing and small deformational, sinusoidal shearing motions of surfaces are generalized through the definitions of viscometric and rheometrical periodic surface flows, respectively. Constitutive equations for the total surface stress tensor are presented which can accommodate realistic non-Newtonian behavior under arbitrary kinematical circumstances. Film properties associated with the above constitutive equations are defined which, in addition to the equilibrium surface tension, completely determine mechanical behavior in certain surface flows. Among these properties are the viscometric and complex surface viscosities. Methods for determining the viscometric and complex surface viscosities using the deep channel surface rheometer of Burton and Mannheimer are considered. Dissert. Abstr.

N76-29535*# Scientific Translation Service, Santa Barbara, Calif.
NEW RESULTS OF SEPARATED FLOW STUDIES
A. I. Golubinskiy, G. I. Maykapar, and V. Ya. Neyland Washington NASA Aug. 1976 94 p refs Transl. into ENGLISH from "Otryvnyye Techeniya" (Moscow), 1973 p 234-302
(Contract NASw-2791)
(NASA-TT-F-17130) Avail: NTIS HC $5.00 CSCL 20D

A description is given of theoretical and empirical methods of calculating heat transfer in the case of separated flows at subsonic, supersonic, and hypersonic velocities. Author

N76-29536*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLE AND CHARTS OF EQUILIBRIUM NORMAL SHOCK AND SHOCK TUBE PROPERTIES FOR PURE ARGON WITH VELOCITIES TO 18 km/sec
Charles G. Miller, III and Sue E. Wilder Washington NASA 1976 302 p refs
(NASA-SP-3098) Avail: NTIS HC $9.75 CSCL 20D

Equilibrium thermodynamic and flow properties are presented in tabulated and graphical form for moving, standing, and reflected normal shock waves in pure argon. Properties include pressure, temperature, density, enthalpy, speed of sound, entropy, molecular-weight ratio, isentropic exponent, velocity, and species mole fractions. Incident (moving) shock velocities are varied from 2 to 18 km/sec for a range of initial pressure of 5 N/sq m to 500 kN/sq m. Working charts illustrating shock tube performance with argon test gas and heated helium and hydrogen driver gases are also presented. Author

N76-29537*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRESSURE MODULATING VALVE Patent Application
D. S. Jacob, inventor (to NASA) (Beckman Instruments, Inc., Anaheim, Calif.) Filed 26 Jul. 1976 10 p Sponsored by NASA
(NASA-Case-MSC-14905-1; US-Patent-Appl-SN-708795) Avail: NTIS HC $3.50 CSCL 20D

A constant flow rate fluid delivery system which may be used in either gravity conditions for delivery of fluid from a flexible container, such as various intravenous solutions, is proposed. The fluid pressure is constant during delivery and is controlled by a modulating control valve. NASA

N76-29538*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
HEAT SHIELD CHARACTERIZATION: OUTER PLANET ATMOSPHERIC ENTRY PROBE
S. A. Mezines, E. L. Rusert, and E. F. Disser May 1976 66 p refs
(Contract NAS2-9027)
(NASA-CR-137881) Avail: NTIS HC $4.50 CSCL 20D

A full scale carbon phenolic heat shield was fabricated for the Outer Planet Probe in order to demonstrate the feasibility of molding large carbon phenolic parts with a new fabrication processing method (multistep). The sphere-cone heat shield was molded as an integral unit with the nose cap plies configured into a double inverse chevron shape to achieve the desired ply orientation. The fabrication activity was successful and the feasibility of the multistep processing technology was established. Delaminations or unbonded plies were visible on the heat shield and resulted from excessive loss of resin and lack of sufficient pressure applied on the part during the curing cycle. A comprehensive heat shield characterization test program was conducted, including: nondestructive tests with the full scale heat shield and thermal and mechanical property tests with small test specimen. Author

N76-29539*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF REACTIVE AND NONREACTIVE TURBULENT COAXIAL JETS
Roop N. Gupta and N. T. Wakelyn Washington NASA Aug. 1976 39 p refs
(NASA-TN-D-8127; L-10636) Avail: NTIS HC $4.00 CSCL 20D

The hydrodynamic properties and the reaction kinetics of axisymmetric coaxial turbulent jets having steady mean quantities are investigated. From the analysis, limited to free turbulent boundary layer mixing of such jets, it is found that the two-equation model of turbulence is adequate for most nonreactive flows. For the reactive flows, where an allowance must be made for second order correlations of concentration fluctuations in the finite rate chemistry for initially inhomogeneous mixture, an equation similar to the concentration fluctuation equation of a related model is suggested. For diffusion limited reactions, the eddy breakup model based on concentration fluctuations is found satisfactory and simple to use. The theoretical results obtained from these various models are compared with some of the available experimental data. Author

N76-29540*# Stanford Univ., Calif. Thermosciences Div.
A STUDY OF ADVERSE PRESSURE GRADIENT TURBULENT BOUNDARY LAYERS WITH OUTER REGION NON-EQUILIBRIUM
P. G. Parikh, W. M. Kays, and R. J. Moffat Jul. 1976 77 p refs
(Grant NGL-05-020-134)
(NASA-CR-148600; SU-HMT-26) Avail: NTIS CSCL 20D

The objective of the study was to acquire hydrodynamic and heat transfer data for turbulent boundary layers evolving under a free stream velocity distribution of the type, U sub infinity = U sub 0 - alpha x, alpha = const. This type of free stream velocity distribution leads to turbulent boundary layers with outer region nonequilibrium. The skin friction data presented were derived from measured velocity profiles, employing Andersen's law-of-the-wall. The Stanton number data were obtained by a direct energy balance on the heat transfer surface. Finally, it was shown that the data on turbulent boundary layers with outer region nonequilibrium may be predicted using a pure mixing length model. Author

N76-29541# Sandia Labs., Albuquerque, N.Mex.
ORIENTATION EFFECTS ON ENVIRONMENTAL STABILITY OF SINTERED FLOW-CONTROL DEVICES
R. M. German Dec. 1975 30 p refs
(Contract AT(29-1)-789)
(SAND-75-8055) Avail: NTIS HC $5.00

Sintered flow-control devices were subjected to moderately adverse environmental tests. Flow rate stability was found to be orientation dependent in only one case. A modified device incorporating protective open porosity regions around the critical flow paths is shown to be a superior design, for which tests in water vapor and oil vapor show an improved flow stability worthy of consideration for future applications. Also, preliminary tests on platinum sintered flow-control devices indicate that this material may be an acceptable alternative (should one become necessary) to the present 304L stainless steel. Author (ERA)

N76-29542# Oak Ridge Gaseous Diffusion Plant, Tenn.
TWO-PHASE FLOW PRESSURE DROP AND HEAT TRANSFER CHARACTERISTICS OF REFRIGERANTS IN VERTICAL TUBES
P. A. Jallouk Jan. 1976 579 p refs
(Contract W-7405-eng-26)
(K-1864) Avail: NTIS HC $14.75

An experimental study was made of the flow regime, pressure drop, heat transfer coefficient, and critical heat flux of R-114 boiling in a 0.785-in.-ID, 10-ft-long vertical tube. The boiling temperature was varied in the range of 100 to 250 F for all tests except the heat transfer coefficient runs where the range 100 to 200 F was studied. Analytic and experimental techniques were used to investigate the heat transfer and pressure drop characteristics. An improvement in the prediction of the system behavior was obtained and the discrepancies between the behavior of boiling refrigerants and other working fluids was explained. Equations were developed or existing ones verified so that design engineers requiring information on the two-phase flow characteristics of refrigerants in vertical tubes at operating conditions not too different from those studied here may use the equations presented here. The limitations of each equation are also presented. Author (NSA)

N76-29543# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
COMPUTATION OF STEADY COMPRESSIBLE SWIRL FLOWS WITH CLOSED STREAMLINES AT HIGH REYNOLDS NUMBERS Technical Interim Report
Karl G. Guderley, David E. Greene and Marian Valentine Jun. 1975 197 p refs
(AF Proj. 7071)
(AD-A017766; ARL-TR-75-0193) Avail: NTIS CSCL 20/4

Flows with closed streamlines in a swirl chamber can be computed with equations in which viscosity and heat conduction are neglected provided that the entropy, the swirl, and the Bernoulli constant, in their dependence upon the stream-function, are chosen in such a manner that the cumulative effects of viscosity and heat conduction (computed from the Navier Stokes equations and the energy equation) vanish. The computation of the flow field and an interative modification of the three functions mentioned above are described. The resulting flow fields were analyzed from the point of view of thermodynamics. The particles underwent a thermodynamic cycle with heat input from the dissipation and heat conduction of the primary flow and heat output through heat conduction of the secondary flow. The Prandtl number is shown to be very important. Under present conditions where the prevalent heat input occurs at low temperatures, it is shown to hinder the secondary motion. Physically, this can be explained as a buoyancy effect. Author

N76-29544# Florida State Univ., Tallahassee. Dept. of Oceanography.
EXPERIMENTAL ROTATING FLOW Final Report
1975 5 p
(Contract N00014-67-A-0235-0009)
(AD-A021212) Avail: NTIS CSCL 20/4

The transient motion of a rotating and stably stratified fluid in a rigid closed cylinder driven by an impulsive change in the rotation rate was investigated using a laser-Doppler velocimeter (LDV). GRA

N76-29545# Naval Ship Research and Development Center, Bethesda, Md.
EXPERIMENTAL DETERMINATION OF HYDRODYNAMIC LOADING FOR TEN CABLE FAIRING MODELS
R. Folb Nov. 1975 81 p refs
(ZF54544001)
(AD-A021588; DTNSRDC-4610) Avail: NTIS CSCL 13/10

The David W. Taylor Naval Ship Research and Development Center has undertaken the measurement of the two-dimensional hydrodynamic loading on faired cable models as the first part of a program to improve towing configuration prediction capability. The experimental approach consists of measuring the normal and tangential hydrodynamic force components on models towed in the high speed basin over a range of speeds, cable angles, and wetted lengths, using a special Cable Fairing Dynamometer. From these measurements the drag coefficients and hydrodynamic loading functions are obtained. To date, ten fairing models have been so characterized. The value of these loading functions to configuration prediction remains to be demonstrated by correlation with at-sea measurements. GRA

N76-29546# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF GRAVITATIONAL EFFECTS ON A VARIABLE CONDUCTANCE HEAT PIPE UTILIZING LIQUID CRYSTAL THEROMOGRAPHY M.S. Thesis
William Henry Batts, Jr. Dec. 1975 54 p refs
(AD-A021865) Avail: NTIS CSCL 13/1

Observations were made of the operation of a gas loaded, variable conductance heat pipe two inches in diameter and sixty inches long. The heat pipe was operated in the horizontal and vertical positions while input power was varied from twenty five to one hundred fifty watts. Liquid crystal thermographic techniques were used to observe the temperature gradients existing when non-condensible gases both heavier and lighter than the working fluid had been introduced. Methanol was used as the working fluid; krypton and helium were the non-condensible gases. Isothermal maps, photographs of liquid crystal displays, and summarized temperature data for the various operating conditions are presented. Author (GRA)

N76-29547# Naval Postgraduate School, Monterey, Calif.
THE INFLUENCE OF ARTIFICIAL CAVITIES ON NATURAL CONVECTION HEAT TRANSFER FROM A HORIZONTAL SURFACE M.S. Thesis
Apichart Penkitti Dec. 1975 66 p refs
(AD-A021825) Avail: NTIS CSCL 20/4

The objective of this project was to study the effect of small artificial cavities on natural convection from a horizontal surface. Tests were run with Freon 113. Data for heat flux as a function of bulk temperature difference were carefully obtained. These data yielded Nusselt number as a function of Grashof number or Rayleigh number. All of these were then compared with the data obtained in previous investigation. Experimental results are presented for the heat transfer from horizontal circular disks, with and without artificial cavities. GRA

N76-29548# AiResearch Mfg. Co., Phoenix, Ariz.
SEPARATED FLOW PROGRAM FOR OFFICE OF NAVAL RESEARCH Technical Report, 15 Jun. 1974 - 31 Dec. 1975
P. R. Dodge 5 Feb. 1976 148 p refs
(Contract N00014-74-C-0317; NR Proj. 061-221)
(AD-A021787; Rept-74-211196-5) Avail: NTIS CSCL 20/4

This document describes the results of a study conducted

during the past year and one-half (from June 15, 1974 to December 31, 1976) for evaluating a numerical method for the solution of the ensemble-averaged Navier-Stokes equations.GRA

N76-29549# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
EFFECTS OF INITIAL BOUNDARY LAYER CONDITIONS ON JET MIXING Final Report, 1 May 1974 - 30 Apr. 1975
William G. Hill, Jr., Richard C. Jenkins, and Barry L. Gilbert Wright-Patterson AFB, Ohio AFAPL Sep. 1975 108 p refs (Contract F33615-74-C-4082; AF Proj. 7116)
(AD-A021511; RE-508; AFAPL-TR-75-67) Avail: NTIS CSCL 20/4

This report describes an experimental investigation of the effects of nozzle exit boundary layer conditions on turbulent mixing in free jets. Mean velocity and turbulence measurements were obtained in flow fields produced by several axisymmetric and two dimensional nozzles with exit velocities in the range of 30 to 800 ft/sec. With tripped turbulent initial boundary layers, spatial mixing rates were found to be independent of jet exit velocity, the mean flow fields scaled with nozzle exit dimensions, and the same results were obtained with different air supply facilities. With laminar and transitional initial nozzle boundary layers the core lengths were found to be unpredictable, showing large changes with both nozzle exit dimensions and velocity, and displaying a strong dependence on air supply facility characteristics. A clear conclusion from our investigation was in experimental testing of models incorporating free jets, the nozzle wall boundary layer must be turbulent to eliminate a frequent source of poor agreement between model and full scale hardware performance.
Author (GRA)

N76-29550# Naval Research Lab., Washington, D.C.
EXTENSION OF HOMOGENEOUS FLUID METHODS TO THE CALCULATION OF SURFACE DISTURBANCE INDUCED BY AN OBJECT IN A STRATIFIED OCEAN Final Report
Michael H. Reilly 24 Feb. 1976 75 p refs
(AD-A022014; NRL-7942) Avail: NTIS CSCL 15/4

An extension of homogeneous fluid methods has been developed for calculation of the disturbance induced by a submerged point source in an incompressible, density-stratified fluid with a free surface. The extension comes in the treatment of the inhomogeneous wave equation, which results from linearization and Fourier transformation of the equations of motion. A closely related problem is the solution of the one-dimensional Schrodinger equation, where the negative squared Brunt-Vaisala frequency profile plays the role of the depth-dependent potential. A model potential with known bound state and continuum state eigenfunctions is substituted into the inhomogeneous wave equation, which is solved, subject to the free surface boundary condition, by an eigenfunction expansion method. Surface tension effects are also included. Contour integration techniques assist the evaluation of integrals and enable a clear separation of localized and extended wavelike disturbances. The point-source solutions may be used to calculate fluid disturbance in the near and far fields induced by a submerged body. As an example, the localized surface displacement and rate of strain induced by a surmerged Rankine ovoid are calculated for a square-well density-stratification model. The results are compared to previously calculated far-field internal wave effects induced on the surface by wake collapse behind a submerged body.
Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-29551* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETECTOR ABSORPTIVITY MEASURING METHOD AND APPARATUS Patent
Ronald E. Sheets, inventor (to NASA) (Tamarack Sci. Co., Inc.) Issued 27 Jul. 1976 5 p Filed 19 Mar. 1975 Supersedes N75-19629 (13 - 11, p 1251) Sponsored by NASA
(NASA-Case-LAR-10907-1; US-Patent-3,971,940; US-Patent-Appl-SN-559845; US-Patent-Class-250-340; US-Patent-Class-250-353) Avail: US Patent Office CSCL 14B

A method and apparatus for measuring the absorptivity of a radiation detector by making the detector an integral part of a cavity radiometer are described. By substituting the detector for the surface of the cavity upon which the radiation first impinges a comparison is made between the quantity of radiation incident upon the detector and the quantity reflected from the detector. The difference between the two is a measurement of the amount of radiation absorbed by the detector.
Official Gazette of the U.S. Patent Office

N76-29552* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUN ANGLE CALCULATOR Patent
Anne Flippin (Kentron Hawaii Ltd., Dallas) and Arthur L. Schmitt, inventors (to NASA) Issued 27 Jul. 1976 6 p Filed 11 Dec. 1974 Supersedes N75-15019 (13 - 06, p 0655)
(NASA-Case-MSC-12617-1; US-Patent-3,971,915; US-Patent-Appl-SN-513576; US-Patent-Class-235-61NV; US-Patent-Class-235-88M; US-Patent-Class-235-78M) Avail: US Patent Office CSCL 14B

A circular computer and system is disclosed for determining the sun angle relative to the horizon from any given place and at any time. The computer includes transparent, rotatably mounted discs on both sides of the circular disc member. Printed on one side of the circular disc member are outer and inner circular sets of indicia respectively representative of site longitude and Greenwich Mean Time. Printed on an associated one of the rotatable discs is a set of indicia representative of Solar Time. Printed on the other side of the circular disc member are parallel lines representative of latitude between diametral representations of North and South poles. Elliptical lines extending between the North and South poles are proportionally disposed on the surface to scale Solar Time in hours.
Official Gazette of the U.S. Patent Office

N76-29553*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MANUFACTURING TECHNIQUES FOR GYROSCOPES IN GRAVITY PROBE B
John R. Rasquin Jul. 1976 31 p
(NASA-TM-X-73321) Avail: NTIS HC $4.00 CSCL 14B

The design of the fused silica gyroscope configuration is presented. The first gyroscope was made for erection and spin tests only and does not contain the angle readout loops necessary for a functioning experimental gyroscope. The rotor ball described is not coated with the ultimate material, niobium, but instead with a sandwich of titanium, cooper, and titanium for spin-up test purposes. Background, historical information, manufacturing procedures, and sketches for this gyroscope are included to provide a better understanding of the device and the techniques and special tools required to manufacture a fused silica gyroscope to the required specifications.
Author

N76-29554*# American Science and Engineering, Inc., Cambridge, Mass.
DEVELOPMENT AND EVALUATION OF A HADAMARD TRANSFORM IMAGING SPECTROMETER AND A HADAMARD TRANSFORM THERMAL IMAGER Final Report
Martin Harwit, Roderick Swift, Richard Wattson, John Decker, and Ralph Paganetti [1976] 112 p refs
(Contract NAS1-12690)
(NASA-CR-145036; ASE-3851) Avail: NTIS HC $5.50 CSCL 14B

A spectrometric imager and a thermal imager, which achieve multiplexing by the use of binary optical encoding masks, were developed. The masks are based on orthogonal, pseudorandom digital codes derived from Hadamard matrices. Spatial and/or spectral data is obtained in the form of a Hadamard transform of the spatial and/or spectral scene; computer algorithms are

then used to decode the data and reconstruct images of the original scene. The hardware, algorithms and processing/display facility are described. A number of spatial and spatial/spectral images are presented. The achievement of a signal-to-noise improvement due to the signal multiplexing was also demonstrated. An analysis of the results indicates both the situations for which the multiplex advantage may be gained, and the limitations of the technique. A number of potential applications of the spectrometric imager are discussed. Author

N76-29555*# Scientific Translation Service, Santa Barbara, Calif.
IONIZING RADIATION IN AVIATION AND SPACE TECHNOLOGY
I. K. Zykov and S. B. Varyushchenko Washington NASA Aug. 1976 160 p refs Transl. into ENGLISH of "Ioniziruyushchiye izlucheniya v aviatsionnoy i kosmicheskoy tekhnike" Moscow, Atomizdat Press, 1975 p 1-128
(Contract NASw-2791)
(NASA-TT-F-17099) Avail: NTIS HC $6.75 CSCL 14B

The general principles of the design of measuring devices based on the use of ionizing radiation to determine various parameters in aerospace technology are considered. The basic theoretical propositions for the measuring methods, and possibilities of their practical realization and the results of experimental investigations and practical application are briefly discussed. The information is intended for engineering and technical workers occupied with the design, introduction, and operation of measuring devices in aerospace technology. Author

N76-29556# Polish Academy of Sciences, Warsaw.
USE OF HOLOGRAPHIC INTERFEROMETRY FOR THE STUDY OF HIGH-PRESSURE ARCING [ZASTOSOWANIE INTERFEROMETRII HOLOGRAFICZNEJ DO BADANIA WYSOKOCISNIENIOWEGO WYLADOWANIA LUKOWEGO]
Andrzej Cybulski and D. Wroblewski 5 Dec. 1975 16 p refs In POLISH
Avail: NTIS HC $3.50

The possibility is studied for utilizing holographic interferometry to measure the distribution of the coefficient of refraction and the concentration of mercury vapors in arcing in a high-pressure mercury lamp. A method of two expositions (first - in a set state of discharge, second - at 0.5 seconds after extinguishing the lamp) is used which makes it possible to eliminate the effect of optic heterogeneity and changes of the temperature of the discharge chamber walls. A relation between the coefficient of refraction of the plasma and the concentration of unexcited atoms is given. To calculate the distribution of the coefficient of refraction of the gas, the Abel transformation is used. The obtained interferograms and tables of concentration and temperature of the mercury vapors are presented.
Transl. by M.J.S.

N76-29557# Dayton Univ., Ohio.
EVALUATION OF A RADIOGRAPHIC PAPER SYSTEM USING ULTRAVIOLET FLUORESCENT SCREENS. PART 2: SUMMARY OF PART 1, TECHNIQUES AND SENSITIVITY DATA FOR F-2 SCREEN, APPLICATIONS Final Technical Report, Mar. 1972 - Aug. 1973
J. A. Holloway Mar. 1975 156 p refs
(Contract F33615-70-C-1337; AF Proj. 7351)
(AD-A021068; AFML-TR-72-165-Pt-2) Avail: NTIS CSCL 14/2

A radiographic paper system has been evaluated with and without ultraviolet fluorescent screens over an X-ray energy range from 25 KVCP to 160 KVCP in order to determine its potential for supplementing X-ray film at a cost savings. Part I of this report gave the technique curves for 2024 aluminum from 25 KVCP to 150 KVCP without screens and with Kodak Industrex Intensifying Screen F-1. Detail sensitivity obtained with penetrameters was reported at 2% for this screen over part of this energy range for selected thicknesses of aluminum. Comparison of film and paper radiography was made using two different types of fluorescent screens with aluminum and titanium honeycomb samples. Part II gives the technique curves for 2024 aluminum from 25 KVCP to 160 KVCP with Kodak Industrex Intensifying Screen F-2. Detail sensitivity using penetrameters is reported for selected aluminum thicknesses over this energy range, together with the sensitometric properties such as the characteristic curve, gradient, exposure latitude, and speed of exposure. GRA

N76-29558# Brookhaven National Lab., Upton, N.Y.
LINEAR POSITION SENSITIVE COUNTER SYSTEM FOR PROTEIN CRYSTALLOGRAPHY
J. E. Cain, J. C. Norvell, J. Alberi, and B. P. Schoenborn 1975 15 p refs Presented at the Symp. on Neutron Scattering for the Analysis of Biol. Struct., Upton, N. Y. Sponsored by ERDA (BNL-20696; Conf-750629-6) Avail: NTIS HC $3.50

A position-sensitive counter system for collecting neutron diffraction data from protein crystals is described. A linear position-sensitive detector is utilized to permit faster data collection and allow the use of smaller crystals. Data are collected in a normal beam geometry with crystal rotation. Preliminary results obtained on a Cd derivative of myoglobin are reported.
ERA

N76-29559# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
LIQUID LEVEL INSTRUMENTATION IN VOLUME CALIBRATION Final Report
H. H. Ku, J. F. Houser, R. M. Schoonover, and J. R. Whetstone Oct. 1975 37 p refs Sponsored in part by Brookhaven Natl. Lab.
(PB-250859/6; NBSIR-75-900) Avail: NTIS HC $4.00 CSCL 14B

The technique of pressure head measurement for determining liquid levels in tanks has been used for the intercomparison of commercially available electromanometers with themselves and a sight glass. In addition to obtaining intercomparison information, the high precision of these devices coupled with that of volumetric transfer techniques demonstrates the applicability of the calibration method in determining departures of the actual tank geometry from that of a model straight walled geometry. It is shown that the calibration of the volume-to-height relationship of a 3,300 liter tank may be accomplished with an uncertainty in this relationship of approx. 4 parts in 10,000. GRA

N76-29560# Hughes Research Labs., Malibu, Calif.
TEST EVALUATION AND MODIFICATION OF PROTOTYPE ROTATING GRAVITY GRADIOMETER Final Report, 1 May - 30 Jun. 1975
C. B. Ames, Robert L. Forward, Philip M. LaHue, and David W. Rouse L. G. Hanscom Field, Mass. AFCRL Jul. 1975 128 p refs
(Contract F19628-75-C-0201; AF Proj. 8607)
(AD-A020275; AFCRL-TR-75-0419) Avail: NTIS CSCL 08/5

The report discusses the cause of the rotating gravity gradiometer spin bearing failures and covers detailed design, fabrication, and testing of a new hydrodynamic journal oil bearing. The new bearing is specifically designed to operate in a vacuum. GRA

N76-29561# Naval Material Command, Washington, D.C.
AUTOMATIC TESTING, A TOOL FOR IMPROVING FLEET READINESS
George W. Neumann Mar. 1976 17 p Presented at the 13th Annual Technical Symp., Arlington, Va., 12 Mar. 1976
(AD-A022307) Avail: NTIS CSCL 14/2

During the last few years the realization that automatic testing is a convenient tool for reducing manpower and costs has become apparent. However, if the application of automation is not properly done, the end result can actually increase costs and cause many other problems. This paper discusses Navy problems in automatic testing and some remedies. Included will be a discussion of the following topics: (1) an RDT and E program for development of automated testing program for development of automated testing techniques; (2) selection and acquisition of the proper Automatic Test Equipment (ATE) (i.e. built-in, special purpose, general purpose, self-test); (3) problems in acquiring ATE software; (4) standardization of ATE; and (5) description of available organizations, tools and aids to assist in acquiring and applying ATE. Author (GRA)

N76-29562# National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
EVALUATION OF TRANSPARENT ELECTRO-

PHOTOGRAPHIC FILM AND CAMERA SYSTEM Interim Report
Thomas C. Bagg Jan. 1976 11 p Sponsored in part by the Navy
(AD-A021255; NBSIR-76-991) Avail: NTIS CSCL 14/5

On behalf of the Naval Supply Systems Command, the National Bureau of Standards was requested to assist in the evaluation of new microfilm techniques and materials which permit the adding-on of images at various times. This is an interim report on the initial evaluation of the AB Dick/Scott System 200 which uses transparent electrophotographic materials. GRA

N76-29563# Hughes Research Labs., Malibu, Calif.
X-RAY LITHOGRAPHY SYSTEM (COMPLETE WITH INTERDIGITAL TRANSDUCER MASTER) Final Report, 1 Dec. 1974 - 30 Aug. 1975
Paul A. Sullivan Nov. 1975 100 p refs
(Contract F19628-75-C-0105; ILIR Proj. 4F-01)
(AD-A020354; D3614; AFCRL-TR-75-0573) Avail: NTIS CSCL 14/5

The report describes the design and fabrication of an X-ray lithography system for the fabrication of surface acoustic wave devices. Research was conducted on a beryllium X-ray window, a 10 kV, 33 mA, Pierce-geometry electron gun, a heat-pipe-cooled aluminum target, a helium-filled exposure chamber, an X-ray flux monitoring system, and a silicon membrane X-ray mask with 0.5 micrometer thick gold absorber patterns consisting of three interdigital transducers with 0.5 micrometer wide lines and spaces. Research results and test data are included in the report. The report also describes the fabrication and testing of a complete system which provides an exposure flux of 2 J/sq cm at the resist (suitable for polymethylmethylmethacrylate resist) in 2 hours with a penumbral shadow of only 0.2 micrometer for a 2.54 cm target-to-mask distance and a 5 micrometer mask-to-substrate gap. GRA

N76-29564# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DUAL PLATE SPECKLE PHOTOGRAPHY Final Report, Jun. 1974 - Mar. 1975
Frank D. Adams and Gene E. Maddux Wright-Patterson AFB, Ohio AFFDL Oct. 1975 34 p refs
(AF Proj. 1367)
(AD-A020295; AFFDL-TR-75-92) Avail: NTIS CSCL 14/5

A method for measuring in-plane displacement using two laser speckle photographs is described. The technique allows the user to cancel rigid body translation and rotation. This increases the measurement accuracy of relative displacements associated with load induced strains. The technique involves making separate speckle photographs of a test specimen. One is made with no load; the second is made with the specimen loaded (strained). A sandwich is constructed from the two speckle photographs, and data are recovered in a manner similar to that used with conventional speckle photography. However, the fringes generated during data recovery are not strictly Young's fringes. Therefore a curvature of various degrees is encountered. A method of interpreting the fringe pattern is described. Author

N76-29565# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
IMAGE PROCESSING OF INDUSTRIAL RADIOGRAPHS
J. A. Holloway, W. L. Shelton, and J. Mitchell Mar. 1975 41 p refs
(AF Proj. 7351)
(AD-A020956; AFML-TR-75-46) Avail: NTIS CSCL 14/5

The report documents the data accumulated as a result of a survey of various approaches to radiographic image processing conducted by the Air Force Materials Laboratory. A detailed discussion of each method is presented, together with the results of an evaluation of several typical systems using a set of control radiographs. Systems evaluated include electronic or electromechanical, using both analog and digital techniques as well as photographic approaches to image processing. Author (GRA)

N76-29566# Systems Science and Software, La Jolla, Calif.
GROUND MOTION GAUGE DEVELOPMENT Final Report, 1 Aug. 1974 - 30 May 1975
P. Coleman, W. Ginn, and D. Grine Sep. 1975 118 p refs
(Contract DNA001-73-C-0213; DNA Proj. NWET-J11AAXSX352)
(AD-A020194; SSS-R-75-2641; DNA-3702-F) Avail: NTIS CSCL 14/2

The overall objective of this work was the review, design, and improvement of techniques for the measurement of the effects of explosions. The report describes continued development of an integrated-accelerometer gauge suitable for recording particle velocity in rock or soil. A drop bar apparatus was modified to allow independent calibration of the completed gauge. Lab tests indicate that proper 'aging' can greatly reduce accelerometer zero shifts caused by high peak accelerations. Data are presented from the airblast measurements in the recent HARDPAN I-2 event. A magnetic technique for statically measuring ground displacement and rotation is analyzed. GRA

N76-29567# Naval Training Equipment Center, Orlando, Fla.
THE EFFECT OF NONUNIFORM LASER ILLUMINATION ON PHOTOGRAPHIC DENSITY LEVELS
Frank J. Oharek Feb. 1976 14 p refs
(AD-A021889; NAVTRAEQUIPC-IH-258) Avail: NTIS CSCL 14/8

There are a number of training devices that can or do make use of photo-optical memories. Optical memories have application to other simulators such as forward looking infrared simulators and low light level television simulators. Recently an optical memory system was proposed as a cost-effective approach for the Observed Fire Trainer. NAVTRAEQUIPCEN has as its objectives improving photographic and optical technology to achieve advances in optical memory capabilities. One of the pieces of equipment used in this project is an Optronics International electrooptical scanning and writing system called 'Specscan.' This equipment is being tested to determine its ability to change data formats, update data onplates and reduce cost of plate reproduction and updating through automated plate writing. This technical report analyzes the writing technique employed by Specscan and addresses the problem of nonuniform illumination within a writing cell. GRA

N76-29568# ARO, Inc., Arnold Air Force Station, Tenn.
MEASUREMENT OF RADIATIVE SURFACE PROPERTIES FOR USE OF THE INFRARED SCANNING CAMERA Final Report, 1 Jul. 1974 - 30 Jun. 1975
J. A. Roux AEDC Feb. 1976 28 p refs
(ARO Proj. V35S-62A)
(AD-A020925; ARO-VKF-TR-75-91; AEDC-TR-76-11) Avail: NTIS CSCL 14/5

An integrating sphere reflectometer was assembled for the measurement of radiative properties of surfaces on which temperature may be determined with the infrared scanning camera. The spectral-directional emittance was determined in the wavelength range of 1.3 micrometers equal to or less than Lambda equal to or less than 5.5 micrometers; the view angle was varied from near normal to 30 deg; the temperature range of interest was ambient to 500F. Also, for calibration purposes, a large-aperture blackbody calibration source was designed to operate at temperatures below 250F. The camera can be used for mapping the temperature distribution of test articles in space simulation chambers and also for aerodynamic heating on wind tunnel models. Another potential application for the IR scanning camera is for use in measuring plume radiance (radiant flux) from rocket engines fired in the space simulation chambers. GRA

N76-29569# Office of Naval Research, London (England).
LDA-SYMPOSIUM 1975, TECHNICAL UNIVERSITY OF DENMARK
D. M. McEligot (Karlsruhe Univ., West Germany) 31 Dec. 1975 9 p Conf. held 25-28 Aug. 1975
(AD-A021487; ONRL-C-26-75) Avail: NTIS CSCL 14/2

The symposium covered current progress, largely in Europe, of laser Doppler anemometer (LDA) measurement. Topics covered were (1) limitations on measuring accuracy inherent in the laser Doppler signal, (2) optical systems, (3) optical and flow aspects of particles, (4) attainable precision with various signal processing arrangements (5) signal processing systems, and (6) applications. This report gives an overview of the symposium and brief summaries of selected contributions. GRA

N76-29570# General Microwave Corp., Farmingdale, N. Y.
EXPERIMENTAL MODELS OF RF RADIATION HAZARDS METER Final Technical Report, May 1971 - Mar. 1974
Yen-Chu Wang and Samuel Hopper Jan. 1976 44 p
(Contract F30602-71-C-0276; AF Proj. 1232)
(AD-A021453; RADC-TR-76-10) Avail: NTIS CSCL 06/18

It is well known that exposure to high-power-density electromagnetic radiation can be harmful to people and animals due to the overheating effects on the living tissue. Radiation hazards thus have made it necessary to develop convenient and accurate means of measuring the intensity of radiation (radiated power density). In the past, special probes have been designed to cover the potential hazards in connection with radiation leakage from microwave ovens. Since these appliances are operated at only selected frequencies, the design of these probes has been restricted to this particular need. In order to extend the usefulness of such devices, it became necessary to develop a broadband sensitive probe, preferably one of large dynamic range and one that measures correctly the total radiation exposure as produced by a number of radiating sources. Additionally, it was essential that the probe be so designed that when used in the near field it would yield meaningful measurements. This report deals with this question and describes the design and performance of the probe built in accordance with the principles developed in the theoretical portion of the report. GRA

N76-29571# General Radio Co., West Concord, Mass.
TRACKING SERVOBRIDGE DETECTOR Quarterly Progress Report, 1 Apr. - 30 Jun. 1975
H. P. Stratemeyer 1 Aug. 1975 47 p refs
(Contract DAAB05-73-C-0609)
(AD-A020623; QPR-4) Avail: NTIS CSCL 14/2

The object of the study is to establish production engineering measures to be undertaken for the parts materials and processes used in fabricating tracking servobridge detectors; and to establish the producibility of that item by mass production techniques and with mass production facilities, establish a quality control system, and take such actions as necessary to reduce the time required for delivery of the subject items that will be required in large quantity production for current planning and in the event of an emergency. The tracking servobridge detector is used in conjunction with standard RF bridges for the purpose of measuring quartz crystal parameters with high accuracy. During the reporting period, a breadboard of the Servo/Sweep Module and the complete instrument were tested and performance demonstrated for ECOM personnel. Recommended changes were incorporated in the circuitry and hardware of the two Engineering Samples delivered to ECOM. GRA

N76-29572# Defense Science Board, Washington, D. C.
USE OF OFF-THE-SHELF ELECTRONIC TEST EQUIPMENT TO REDUCE COSTS, SHORTEN LEAD TIMES, ASSURE RELIABILITY, AND SIMPLIFY LOGISTICS
Feb. 1976 127 p refs
(AD-A022063) Avail: NTIS CSCL 14/2

This report presents 28 recommendations based on the studies and deliberations over the past year of the Electronic Test Equipment Task Force of the Defense Science Board. The Task Force proposes methods of implementation for each of its recommendations and estimates that prompt and orderly implementation will yield savings on the order of $80 million per year. Author (GRA)

N76-29573# Naval Research Lab., Washington, D.C.
PERSONAL ATMOSPHERIC GAS SAMPLER WITH CRITICAL ORIFICE. PART 1: DEVELOPMENT AND EVALUATION Interim Report
H. G. Eaton, J. P. Stone, and F. W. Williams 13 Feb. 1976 16 p refs
(NRL Proj. C08-40)
(AD-A021984; NRL-7963-Pt-1) Avail: NTIS CSCL 13/2

A small, lightweight, portable personal sampler designed for collecting time-integrated air samples has been developed. This device uses the critical orifice concept with an evacuated container. Thus the sampling interval is dictated by the size of the orifice and volume of the sampler container. Through proper selection of orifices, this technique is capable of detecting concentration transients or will sample constantly for intervals up to 8 hours with a 100-cc container (shirt-pocket sampler). The personal sampler has been used to evaluate atmospheres containing the contaminants CO, CH4, CO2, CF2Cl2, CFCl3, C2H6, CH2=CHCl, CH2=CCl2, C6H14, and C6H6. Author (GRA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-29574 California Univ., Berkeley.
A STUDY OF FAST TRANSIENT PROCESSES IN NITROGEN-LASER-PUMPED DYE LASERS Ph.D. Thesis
Leonard William Braverman 1975 97 p
Avail: Univ. Microfilms Order No. 76-15120

Three of the output transients of the N2 laser-pumped dye laser were studied. The fast frequency shifts were observed in the laser output during the first few nanoseconds of operation. These frequency shifts are caused by the photon in the laser cavity reaching equilibrium with the active dye. Experimental results were obtained and compared to the theory. Q switching of the N2 laser-pumped dye laser was studied. Q switching of dye laser had not been considered until recently. The production of ultra-short pulses by mode locking the N2 laser-pumped dye laser was studied. Short-pulse mode-locked operation of the dye laser was difficult to achieve due to the short pumping pulse length tau sub p. Some experimental results were obtained, but complete mode locking was never achieved. These results are discussed and compared to the published theory. Dissert. Abstr.

N76-29575* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR GENERATING COHERENT RADIATION IN THE ULTRA-VIOLET REGION AND ABOVE BY USE OF DISTRIBUTED FEEDBACK Patent
Melvin M. Saffren, inventor (to NASA) (JPL) Issued 27 Jul. 1976 8 p Filed 17 Dec. 1974 Supersedes N75-16307 (13 - 07, p 0820) Sponsored by NASA
(NASA-Case-NPO-13346-1; US-Patent-3,972,008;
US-Patent-Appl-SN-533556; US-Patent-Class-331-94.5C;
US-Patent-Class-330-4.3) Avail: US Patent Office CSCL 20E

Helium in the superfluid state emits copious amounts of radiation in the ultraviolet region when excited by an electron stream. Conventional laser action using mirrors is impossible in superfluid helium because there are no mirrors that will reflect VUV radiation. By utilizing the distributed feedback method, the superfluid helium can be made to lase. By setting up a standing wave in superfluid helium that has a wavelength equal to, or harmonically related to, half the wavelength of the photon radiation chosen to be emitted as laser radiation by the superfluid helium, the need for end mirrors to produce reflection of the laser radiation is eliminated and reflection occurs instead at the wavefronts of the standing wave. The photons leave the superfluid helium at right angles to the standing wave as coherent radiation having a very high intensity. The standing wave established in the superfluid helium may be an acoustical standing wave, a thermal standing wave (second sound), or an electric standing wave. Official Gazette of the U.S. Patent Office

N76-29576# Centre National de la Recherche Scientifique, Strasbourg (France).
TEMPORAL RESPONSE AND REAL TIME MEASUREMENTS WITH A 5 GHz PHOTOCELL-OSCILLOSCOPE SYSTEM AT LOW LIGHT LEVELS
B. Sipp, J. A. Miehe, and G. Clement 1975 17 p refs
(CRN-CNPA-75-2) Avail: ERDA Depository Libraries HC $3.50

Picosecond mode locked laser pulses were used to study the performance of fast vacuum photoelectric cells associated with a high sensitivity and high speed cathode ray tube provided with a channel plate electron multiplier. With an amplitude sensitivity of 140 mV/cm an overall time response of less than 100 ps has been measured. Author (ERA)

N76-29577# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
USER'S GUIDE FOR A TERMINAL HOMING MONTE CARLO

SIMULATION UTILIZING A DIGITAL/LINEAR LASER SEEKER
Charles L. Lewis, Abner W. Lee, Jr., and Jay Scott Harrison 2 Feb. 1976 286 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A022352; RG-76-34) Avail: NTIS CSCL 16/2

This report represents a user's guide for a digital/linear laser seeker model which has been added as an update to the existing U.S. Army Missile Command Monte Carlo point target, terminal homing, all-digital simulation program. Random errors due to variations in reflected laser energy level and signal processing gain as well as errors due to target ambiguity are modeled. Input/output variables are defined, and a sample run set is included. Several print and plot output options provide data presentation versatility. GRA

N76-29578# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATIONS INTO THE FEASIBILITY OF HIGH POWER LASER WINDOW MATERIALS Semiannual Technical Report
J. L. Zar 15 Oct. 1975 38 p refs
(Contract F19628-75-C-0066; ARPA Order 2806)
(AD-A021468; AFCRL-TR-75-0605; SATR-2) Avail: NTIS CSCL 20/5

The principle work described in this report is the completion of a laser window test facility. It has been used to test the optical distortion of a diamond window while transmitting focussed radiation from a 10.6 micrometers laser. The continuous power exceeded 18 kilowatts. The average intensity over the focal spot is estimated to be 2,500,000 watts/sq. cm. The optical distortion produced in the windows was measured with an interferometer and found to be 1/2 visible light fringe or less. Some of the other results described in this report are the calibration of the laser window test facility, the measurement of the 10.6 micrometer, C.W. beam intensity profile at various distances from the mirror focus, a description of the calorimeter used to measure power, a description of the holder used to position and cool diamond windows, measurement of the absorption of two diamond plates that have been tested as windows. GRA

N76-29579# Harry Diamond Labs., Adelphi, Md.
LASER TERMINAL HOMING ENGAGEMENT SIMULATOR (EYE SAFE)
Thomas J. Gleason and Melvin E. Sword Dec. 1975 29 p
(HDL Proj. 329532)
(AD-A020546; HDL-TM-75-28) Avail: NTIS CSCL 15/7

The Laser Terminal Homing Engagement Simulator (LATHES) (Eye Safe) was developed by the Harry Diamond Laboratories for the U.S. Army Operational Test and Evaluation Agency. It allows realistic field exercises for tests or training relative to laser terminal homing systems to be conducted without the use of non-eye-safe lasers. The LATHES consists of a designator simulator, target simulator, and seeker simulator allowing simulation of the tactical engagement at realistic ranges. The designator and target simulators are eye safe, and the target simulator is compatible with tactical laser receivers. The LATHES provides a means of testing tactical concepts or training troops in the operational use of laser guided weapons or laser designation and target hand-off procedures without requiring the extensive range safety provisions that are necessary when real target designators are used. GRA

N76-29580# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF THE PERFORMANCE OF INTERSTAGE DUCTS FOR GAS DYNAMIC LASERS M.S. Thesis
Jack T. Stone, Jr. Jun. 1975 106 p refs
(AD-A021734; GAE/AE/75J-5) Avail: NTIS CSCL 20/5

A study was made of the density and velocity distributions in different configurations of a cold flow model of the Airborne Laser Laboratory Interstage Duct. This report includes the results of testing eight different configurations, built on two basic designs. One design had a continuous vortex flow while the other had counter opposing vortex flows being generated at the central cross-section. The parameters in the investigation were the location and size of the purging nozzles, the velocity, and the purge flow rate. The purge flow was air being introduced through nozzles in the perimeter of the interstage duct. The rate at which the radial density gradient increased with increasing flow was almost linear for the continued vortex ducts and asymptotic for the reversed vortex ducts. GRA

N76-29581# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
ATMOSPHERIC TRANSMISSION MEASUREMENTS AT HF AND DF LASER WAVELENGTHS USING A HETERODYNE RADIOMETER Interim Report
Fred I. Shimabukuro, Stephen R. King, Thomas S. Hartwick, Earl E. Reber, and Donald J. Spencer 19 Feb. 1976 33 p refs
(Contract F04701-75-C-0076)
(AD-A022057; TR-0076(6752)-1; SAMSO-TR-76-36) Avail: NTIS CSCL 20/6

Heterodyne radiometric systems operating in the wavelength ranges 2.5-3 micrometers and 3.5-4 micrometers have been constructed and have been used to make atmospheric transmission measurements at selected HF and DF laser lines. The spectral resolution of the system is 0.002/cm, and the measured radiometer NEP was 5 x 10 to the minus 15th power watts for an output time constant of 30 sec. The measured transmissions at HF lines appear less than that predicted by theoretical considerations, while for the DF lines, the measured and calculated transmissions are consistent. GRA

N76-29582# Army Electronics Command, Fort Monmouth, N.J.
A HIGH EFFICIENCY, UNSTABLE RESONATOR, DYE LASER MODULE Final Report
Theodore F. Ewanizky Feb. 1976 22 p refs
(DA Proj. 1S7-62715-A-042)
(AD-A021513; ECOM-4388) Avail: NTIS CSCL 20/5

The performance characteristics of an unstable resonator, rhodamine 6G dye laser module were measured and analyzed. Spectral conversion efficiency of excitation by the second-harmonic of a 10 pulse per second, Q-switched Nd:YAG laser to yellow-green dye laser emission exceeded 40 percent. Beam quality of the dye laser emission was measured to be within two-times diffraction limited. Author (GRA)

N76-29583# Defence Research Establishment Valcartier (Quebec).
GAS RE-CIRCULATION SYSTEM FOR A MINIATURE HIGH REPETITION RATE TEA-CO2 LASER
P. Pace and M. Lacombe Jan. 1976 25 p refs
(AD-A021523; DREV-R-4048/76) Avail: NTIS CSCL 20/5

When an atmospheric pressure transverse discharge CO2 laser with forced gas flow is pulsed at a high repetition rate, the minimum time between arc-free discharges is larger than the time predicted by the ratio of discharge width to gas flow velocity. The maximum pulse rate can be predicted by a flow model, the results of which are summarized. The predictions of the model are compared with the experimental results and the design considerations involved in the construction of the gas re-circulation system are presented. Author (GRA)

N76-29584# Avco-Everett Research Lab., Everett, Mass.
LASER ATMOSPHERIC PROPAGATION KINETICS Final Technical Report, 1 May 1973 - 15 Aug. 1974
Charles A. Brau, Ellen R. Bressel, Sheldon L. Glickler, and R. T. V. Kung Jul. 1975 103 p refs
(Contract N00014-73-C-0311; ARPA Order 1806)
(AD-A022066) Avail: NTIS CSCL 20/5

The absorption of high power laser radiation by the atmosphere is important because the resultant heating of the air causes 'thermal lensing' and nonlinear distortion of the beam. The effects of kinetics manifest themselves in the form of transient, unsteady heating at the beginning of the laser pulse, and bleaching at high intensities. The vibrational and rotational kinetics of the absorption of DF and CO laser radiation have been studied and are described. GRA

N76-29585# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
LASER BEAM SELF-FOCUSING IN GASES Final Report
Stanley Skupsky and Richard K. Osborn Feb. 1976 19 p refs
(Contract DAAD05-73-C-0529; DA Proj. 1T0-62111-A-116)

(AD-A022089; BRL-CR-289) Avail: NTIS CSCL 20/5

A new mechanism which may cause self-focusing of laser light in gases is proposed. We adopt the view point that self-focusing in gases may result from the higher polarizability of excited atoms, and suggest that the mechanism for atomic excitation in non-linear Raman scattering. This is a multi-photon event in which many quanta are absorbed at the laser frequency and one quanta is emitted at any frequency necessary to cause excitation. Author (GRA)

N76-29586# Rochester Univ., N.Y. Lab. for Laser Energetics.
STIMULATED SOFT X-RAY EMISSION IN THE RANGE OF 40 ANGSTROMS TO 140 ANGSTROMS FROM LASER EXCITED MEDIA Semiannual Report
J. Forsyth and M. Lubin 1975 44 p refs
(Contracts N00014-67-A-0398-0017; N00014-72-C-0046)
(AD-A022043) Avail: NTIS CSCL 20/5

The report describes the early phases of a study of processes in a laser produced plasma which it is hoped will lead to the development of a soft X-ray laser. The X-ray spectrum from a plasma of highly ionized aluminum produced by a focussed pulse of light from a large Nd(3+) and glass laser was examined. The focussed intensity reaches approximately 10 to the 14th power watts/sq cm in the experiments. Estimates of the plasma temperature, density, and degree of ionization are made. These estimates agree well with the results of a computer simulation. Moreover, the computer simulation predicts an emission line spectrum which agrees well in detail with the experimental observations. To date the experimental conditions (e.g., laser pulse power, target composition, prepulse timing) have not been varied sufficiently to adequately test the computer model. During the present reporting period, the authors have also constructed a special focusing system which will allow them to produce a laser-heated plasma in the form of a narrow line. GRA

N76-29587# Texas Univ. at Dallas, Richardson.
THE NITROGEN ION LASER Semiannual Technical Report, 1 Jul. - 31 Dec. 1975
Carl B. Collins 31 Dec. 1975 75 p refs
(Contracts N00014-76-C-0174; N00014-67-A-0310-0007; ARPA Order 1807; NR Proj. 016-211)
(AD-A022044; UTDP-ML-04; Rept-7; SATR-1) Avail: NTIS CSCL 20/5

The characterization and thermal scaling of the nitrogen ion laser pumped by charge transfer from He(3-) is reported in this work. Intense laser emission in the violet at 427 nm has been observed and found to have a linewidth less than 0.3 A. The pumping ion, HE(3-), was produced by discharge of a fast-pulsed electron beam gun, APEX-1, into several atmospheres of a mixture of helium and nitrogen. Excitation current densities ranged from 1.1 to 2.5 sq cm at 1 MV over a 1 x 10 cm transverse geometry. Thermal scaling of the laser has been investigated and a strong inverse dependence of laser output on gas temperature was observed. Quasi-CW operation was achieved under these conditions suggesting that much longer output pulses might be obtained with an e-beam pulse of greater duration. GRA

N76-29818 Plessey Radar Ltd., Cowes (England).
A COMPARATIVE STUDY OF ATMOSPHERIC TRANSMISSION AT THREE LASER WAVELENGTHS IN RELATION TO THE METEOROLOGICAL PARAMETERS
P. J. Wright *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

N76-29819 Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
REMOTE AEROSOL SENSING WITH AN ABSOLUTE CALIBRATED DOUBLE FREQUENCY LIDAR
R. Reiter, W. Carnuth, M. Littfass, and N. C. Varshneya (Roorkee Univ.) *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs (For availability see N76-29815 20-46)

N76-29820 Norwegian Defence Research Establishment, Kjeller.
ATMOSPHERIC EFFECTS RELEVANT TO LASER SPECTROSCOPY
T. Lund and A. G. Kjelaas *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

N76-29834 Oregon Graduate Center for Study and Research, Beaverton.
TURBULENCE EFFECTS ON TARGET ILLUMINATION BY LASER TRANSMITTER: UNIFIED ANALYSIS AND EXPERIMENTAL VERIFICATION
J. Richard Kerr *In* AGARD Opt. Propagation in the Atmosphere May 1976 27 p refs Sponsored in part by DARPA and AFSC (For availability see N76-29815 20-46)

N76-29835 Forschungsinstitut Fuer Optik, Tuebingen (West Germany).
PROPAGATION OF FOCUSED LASER BEAMS IN THE TURBULENT ATMOSPHERE
H. Raidt *In* AGARD Opt. Propagation in the Atmosphere May 1976 12 p refs (For availability see N76-29815 20-46)

N76-29836 Pacific Sierra Research Corp., Santa Monica, Calif.
PROPAGATION OF FOCUSED TRUNCATED LASER BEAMS IN THE ATMOSPHERE
R. F. Lutomirski *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs (For availability see N76-29815 20-46)

N76-29838 Rome Univ. (Italy).
INTENSITY CORRELATION OF RADIATION SCATTERED ALONG THE PATH OF A LASER BEAM PROPAGATING IN THE ATMOSPHERE
M. Bertolotti, M. Carnevale (Fondazione Ugo Bordoni, Rome, Italy), B. Crosignani (Fondazione Ugo Bordoni, Rome, Italy), B. Daino (Fondazione Ugo Bordoni, Rome, Italy), and P. DiPorto (Fondazione Ugo Bordoni, Rome, Italy) *In* AGARD Opt. Propagation in the Atmosphere May 1976 9 p refs (For availability see N76-29815 20-46)

N76-29839 Rome Univ. (Italy).
MEASUREMENT OF ATMOSPHERIC ATTENUATION AT 6328 A
M. Bertolotti, M. Carnevale (Fondazione Ugo Bordoni, Rome, Italy), B. Daino (Fondazione Ugo Bordoni, Rome, Italy), M. Galeotti (Fondazione Ugo Bordoni, Rome, Italy), and D. Sette *In* AGARD Opt. Propagation in the Atmosphere May 1976 7 p (For availability see N76-29815 20-46)

N76-29840 Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
MEASUREMENTS OF ANGLE OF ARRIVAL FLUCTUATIONS OF A LASER BEAM DUE TO TURBULENCE
Anna Consortini *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

N76-29841 Plessey Radar Ltd., Cowes (England).
A MULTIPLE SCATTERING CORRECTION FOR LIDAR SYSTEM
J. V. Winstanley and C. Wigmore *In* AGARD Opt. Propagation in the Atmosphere May 1976 13 p refs (For availability see N76-29815 20-46)

N76-29843 Naval Research Lab., Washington, D.C.
PROPAGATION OF HIGH POWER LASER BEAMS THROUGH THE ATMOSPHERE: AN OVERVIEW
John N. Hayes *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs (For availability see N76-29815 20-46)

N76-29844 Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN OVERVIEW OF THE LIMITATIONS ON THE TRANSMISSION OF HIGH ENERGY LASER BEAMS THROUGH THE ATMOSPHERE BY NONLINEAR EFFECTS
S. Edelberg *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

N76-29845 Naval Research Lab., Washington, D.C.
NUMERICAL METHODS IN HIGH POWER LASER PROPAGATION
Peter B. Ulrich *In* AGARD Opt. Propagation in the Atmosphere May 1976 19 p refs (For availability see N76-29815 20-46)

N76-29846 Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE LIMITATIONS IMPOSED BY ATMOSPHERIC BREAKDOWN ON THE PROPAGATION OF HIGH POWER LASER BEAMS
D. E. Lencioni *In* AGARD Opt. Propagation in the Atmosphere May 1976 12 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

N76-29847 Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL DETERMINATION OF SINGLE AND MULTIPLE PULSE PROPAGATION
R. W. ONeil, H. Kleiman, and H. R. Zwicker *In* AGARD Opt. Propagation in the Atmosphere May 1976 13 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

N76-29849 Consiglio Nazional delle Ricerche, Bologna (Italy).
DETERMINATION OF SLANT VISUAL RANGE FROM LIDAR SIGNATURES, ANALYSIS OF SIMULATED SIGNATURES
Mario Gazzi, Vittorio Vicentini, Luca Pantani, Bruno Radicati, Leopoldo Stefanutti, and Christian Werner (DFVLR) *In* AGARD Opt. Propagation in the Atmosphere May 1976 19 p refs (For availability see N76-29815 20-46)

N76-29858 Eltro G.m.b.H., Heidelberg (West Germany).
USING LIDAR FOR MEASURING VISIBILITY
James F. Ruger *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-29588* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST BEARING Patent
William J. Anderson, inventor (to NASA) Issued 27 Jul. 1976 6 p Filed 25 Jun. 1975 Supersedes N75-26378 (13 - 17, p 2123)
(NASA-Case-LEW-11949-1; US-Patent-3,971,602; US-Patent-Appl-SN-590182; US-Patent-Class-308-160; US-Patent-Class-308-163; US-Patent-Class-308-170) Avail: US Patent Office CSCL 13I

A gas lubricated thrust bearing is described which employs relatively rigid inwardly cantilevered spokes carrying a relatively resilient annular member or annulus. This annulus acts as a beam on which are mounted bearing pads. The resilience of the beam mount causes the pads to accept the load and, with proper design, responds to a rotating thrust-transmitting collar by creating a gas film between the pads and the thrust collar. The bearing may be arranged for load equalization thereby avoiding the necessity of gimbal mounts or the like for the bearing. It may also be arranged to respond to rotation in one or both directions. Official Gazette of the U.S. Patent Office

N76-29589 Brown Univ., Providence, R.I.
THEORETICAL AND EXPERIMENTAL STUDIES OF THERMODYNAMIC, FLUID DYNAMIC AND METALLURGICAL PHENOMENA IN ELECTRIC DISCHARGE MACHINING Ph.D. Thesis
Chen-Hwa Chen 1976 170 p
Avail: Univ. Microfilms Order No. 76-15615

Electric Discharge Machining (EDM) surfaces of different materials were closely investigated by using both optical and scanning electron microscopes. It was found that there were metal bubbles formed on all steels tested, independent of their carbon content. These bubbles are of complex shape and some of them had partially burst from the top before freezing. The heat-affected zones of steel samples show the results of hardness increasing, microstructural change, gas diffusion, metal transferring, thermal cracks, etc. The predominant mechanism of the liquid metal removal is determined by both theoretical and experimental studies. It is postulated that the main mechanism responsible for the liquid metal removal from the erosion crater is the radial pressure gradient induced by the electric magnetic effect of the discharge column. Dissert. Abstr.

N76-29590* National Aeronautics and Space Administration. Pasadena Office, Calif.
STIRLING CYCLE ENGINE AND REFRIGERATION SYSTEMS Patent
Walter H. Higa, inventor (to NASA) (JPL) Issued 27 Jul. 1976 9 p Filed 5 May 1975 Supersedes N75-22747 (13 - 14, p 1659) Sponsored by NASA
(NASA-Case-NPO-13613-1; US-Patent-3,971,230; US-Patent-Appl-SN-574208; US-Patent-Class-62-6) Avail: US Patent Office CSCL 13I

A Stirling cycle heat engine is disclosed in which displacer motion is controlled as a function of the working fluid pressure P sub 1 and a substantially constant pressure P sub 0. The heat engine includes an auxiliary chamber at the constant pressure P sub 0. An end surface of a displacer piston is disposed in the auxiliary chamber. During the compression portion of the engine cycle when P sub 1 rises above P sub 0 the displacer forces the working fluid to pass from the cold chamber to the hot chamber of the engine. During the expansion portion of the engine cycle the heated working fluid in the hot chamber does work by pushing down on the engine's drive piston. As the working fluid pressure P sub 1 drops below P sub 0 the displacer forces most of the working fluid in the hot chamber to pass through the regenerator to the cold chamber. The engine is easily combinable with a refrigeration section to provide a refrigeration system in which the engine's single drive piston serves both the engine and the refrigeration section.
Official Gazette of the U.S. Patent Office

N76-29591*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF A METHOD TO SHIELD A WELDING ELECTRON BEAM FROM MAGNETIC INTERFERENCE
W. A. Wall Aug. 1976 17 p
(NASA-TM-X-73324) Avail: NTIS HC $3.50 CSCL 13H

It is known that electron beams are easily deflected by magnetic and electrostatic fields. Therefore, to prevent weld defects, stray electromagnetic fields are avoided in electron beam welding chambers if at all possible. The successful results of tests conducted at MSFC to evaluate a simple magnetic shield made from steel tubing are reported. Tests indicate that this shield was up to 85 percent effective in reducing magnetic effects on the electron beam of a welding machine. In addition, residual magnetic fields within the shield were so nearly uniform that the net effect on the beam alignment was negligible. It is concluded that the shield, with the addition of a tungsten liner, could be used in production welding. Author

N76-29592*# Boeing Commercial Airplane Co., Seattle, Wash.
TESTING OF MOLDED HIGH TEMPERATURE PLASTIC ACTUATOR ROAD SEALS FOR USE IN ADVANCED AIRCRAFT HYDRAULIC SYSTEMS Technical Report, Jun. 1974 - Jul. 1976
A. W. Waterman, R. L. Huxford, and W. G. Nelson Jul. 1976 55 p refs
(Contract NAS3-18529)
(NASA-CR-135059; D6-42995) Avail: NTIS HC $4.50 CSCL 11A

Molded high temperature plastic first and second stage rod seal elements were evaluated in seal assemblies to determine performance characteristics. These characteristics were compared with the performance of machined seal elements. The 6.35 cm second stage Chevron seal assembly was tested using molded Chevrons fabricated from five molding materials. Impulse screening tests conducted over a range of 311 K to 478 K revealed thermal setting deficiencies in the aromatic polyimide molding materials. Seal elements fabricated from aromatic copolyester materials structurally failed during impulse cycle calibration. Endurance testing of 3.85 million cycles at 450 K using MIL-H-83283 fluid showed poorer seal performance with the unfilled aromatic polyimide material than had been attained with seals machined from Vespel SP-21 material. The 6.35 cm first stage step-cut compression loaded seal ring fabricated from copolyester injection molding material failed structurally during impulse cycle calibration. Molding of complex shape rod seals was shown to be a potentially controllable technique, but additional molding material property testing is recommended. Author

N76-29593*# Kanner (Leo) Associates, Redwood City, Calif.
FATIGUE DETERIORATION MECHANISMS BY ROLLING-SLIDING Final Report
D. Rousseau Washington NASA Aug. 1976 88 p refs Transl. into ENGLISH of "Etude des mecanismes de deterioration pap fatigue en roulement-glissement (compte-rendu scientifique," (Ugine), report no. 57.229-DR/am, Oct. 1974
(Contract NASw-2790)
(NASA-TT-F-17175; Rept-57.229-DR/am) Avail: NTIS HC $5.00 CSCL 14D

Contact fatigue experiments were performed under both pure rolling and combined rolling and sliding conditions with a bearing steel (100C6) and with a case-hardening steel (20 NCD2). These tests have shown that, even with low surface roughness as compared with lubricating conditions, occurrence of some sliding action lowers contact fatigue resistance, promotes new nucleation mechanisms of spalling, and sweeps away any effect of steel melting practice upon endurance. It is, however, likely that endurance is affected by some other metallurgical parameters, especially grain size. Author

N76-29594*# Scientific Translation Service, Santa Barbara, Calif.
BONDING OF EPOXY PRE-IMPREGNATED LAMINATES TO METAL STRUCTURES
J. Kobes Washington NASA Aug. 1976 11 p refs Transl. into ENGLISH of conf. paper from Plzen, Ceska Vedeckotechnicka Spolecnost, Czechoslovakia. Presented at the 1975 Reinforced Plastics Conf., Czechoslovakia, 13-15 May 1975 p 1-B-15-1 to 1-B-15-5
(Contract NASw-2791)
(NASA-TT-F-17145) Avail: NTIS HC $3.50 CSCL 11A

The advantages of flexible epoxy prepreg interfacing to metal surfaces over bonding of plastics to metals by means of mechanical fasteners (screws, bolts, rivets) are discussed. The use of PXL-43 epoxy prepreg as bonding to aluminum alloy is investigated in particular. Shear stresses, peeling, delamination, interlaminar shear, and stresses acting normal to the place of reinforcement are tested and discussed. Shear strength and binder content are tabulated for several prepreg compositions. Adhesion of PXL-43 prepreg to aluminum alloy is found superior to adhesion by conventional cold epoxy glue or hand layup of laminate directly on the metal surface. PXL-43 prepreg is particularly recommended for adhesion in the manufacture of honeycomb sandwich coverings. Author

N76-29595*# Transemantics, Inc., Washington, D.C.
RAPID STARTING OF GAS TURBINES WITH THE AID OF PRESTRESSED CAST-IRON AIR-STORAGE TANKS
Paul Viktor Gilli and Georg Beckmann Washington NASA Aug. 1976 12 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (West Germany), v. 75, no. 6, 1976 p 116-118
(Contract NASw-2792)
(NASA-TT-F-17133) Avail: NTIS HC $3.50 CSCL 21E

Open gas turbines can start up very rapidly but only with a reduction in their life. In practice therefore rapid starting is avoided as far as possible, so that bridging power is required, for which prestressed cast iron pressure vessels are suitable, in the form of rapid start air storage. This means that the rated output of the set is immediately available. The authors discuss the circuit and the layout. The costs of the installation are increased only by about 20% due to the air storage, by which the gas turbine becomes in an economic manner a back-up reserve which can be used immediately. Author

N76-29596# Polish Academy of Sciences, Warsaw.
COMPLEX STUDIES OF THE EFFECT OF TECHNOLOGICAL FACTORS ON THE PHENOMENON OF SEIZING IN SELECTED MACHINE ELEMENTS [BADANIA KOMPLEKSOWE WPLYWU CZYNNIKOW TECHNOLOGICZNYCH NA ZJAWISKO ZACIERANIA SIE WYBRANYCH ELEMENTOW MASZYN]
Edward Romanowski 14 Jun. 1975 172 p refs In POLISH Avail: NTIS HC $6.75

The goals of the study were to investigate the causes of seizing in the cylinder sleeves of airplane piston engines of the ASz-62IR type, to deepen the level of understanding of the phenomenon of seizing in cylinder sleeves of internal combustion engines, especially of airplane piston engines, and to seek ways of increasing resistance to seizing in such engines. Theoretical considerations based on a critical analysis of the current state of knowledge as well as new investigations are presented. The causes of seizing are thoroughly explained in light of which concrete proposals for its prevention are offered. Author

N76-29597# Polish Academy of Sciences, Warsaw.
DETERMINATION OF ZONES OF CRITICAL SPEEDS OF A ROTOR WITH SIX DEGREES OF FREEDOM, A PROGRAM ON THE ODRA 1204 COMPUTER [WYZNACZANIE OBSZAROW PREDKOSCI KRYTYCZNYCH WIRNIKA O SZESCIU STOPNIACH SWOBODY, PROGRAM NA MM ODRA 1204]
Agnieszka Muszynska 31 Oct. 1975 24 p refs In POLISH Avail: NTIS HC $3.50

The mathematical models of a rotor with six degrees of freedom are discussed. It is shown that it is crucial that the solution is limited, and does not exhibit tendencies of growth. Some tendencies which violate this condition are given. The complete ODRA 1204 program is included. Author

N76-29598*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DUAL-ACTION GAS THRUST BEARING FOR IMPROVING LOAD CAPACITY
Izhak Etsion Washington Jul. 1976 18 p refs
(NASA-TN-D-8279; E-8701) Avail: NTIS HC $3.50 CSCL 13I

The principle of utilizing hydrodynamic effects in diverging films to improve the load carrying capacity in gas thrust bearings is discussed. A new concept of a dual action bearing based on that principle is described and analyzed. The potential of the new bearing is demonstrated both analytically for an infinitely long slider and by numerical solution for a flat sector shaped thrust bearing. It is shown that the dual action bearing can extend substantially the range of load carrying capacity in gas lubricated thrust bearings and can improve their efficiency. Author

N76-29599# Bendix Corp., Kansas City, Kans.
DEVELOPMENT OF AN IMPROVED BONDING FIXTURE
J. D. Sheeley Jan. 1976 21 p refs
(Contract AT(29-1)-613)
(BDX-613-1252-Rev) Avail: NTIS HC $4.00

A bonding laminating fixture with self contained heating, cooling, pressure, and vacuum features was developed. The fixture has a usable platen area of 24 by 36 in. (609.6 by 914.4 mm) and has a control panel which allows the bonding cycle to be programmed for automatic operation. The fixture is used to laminate adhesive coated Mylar or Kapton to etched circuits. Author (ERA)

N76-29600# Fluor Engineers and Constructors, Inc., Los Angeles, Calif.
EVALUATION OF HIGH PRESSURE-HIGH TEMPERATURE PRESSURE VESSEL END CLOSURES AND FLANGED CONNECTIONS
Sep. 1975 36 p refs
(Contract F(49-18)-1517)
(FE-1517-22) Avail: NTIS HC $4.00

The applicability of specific types of pressure vessel end closures and flanged connections for high-pressure, high-temperature processes in coal liquefaction plants, is evaluated. The primary area of investigation is an analysis of the combined effects of pressure (3,000 to 5,000 psig), temperature (up to 900 F), and external mechanical loads. The results of the study summarize the major engineering and design considerations and emphasize the need for thorough analysis and adequate testing. The final section presents a recommended test program to verify the suitability of selected design types for future use in coal liquefaction plants. Author (ERA)

N76-29601# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
COLD-DRAWING SHEET MOLYBDENUM AT ROOM TEMPERATURE
L. W. Shepherd Nov. 1975 19 p ref
(Contract E(29-2)-656)

(GEPP-172) Avail: NTIS HC $4.50

When sheet molybdenum is cold drawn and annealed, the microstructure recrystallizes, and may cause the metal to become brittle, with loss of ductility and strength. Ten to twenty percent recrystallization can occur to destroy optimum drawing quality of the metal. A recrystallization of 4 to 5 percent is ideal. It is shown that special tooling and controlled annealing can hold recrystallization to optimum levels. Special tooling includes an automatic cycling press that closely controls the rate of draw and gives maximum pressure. A draw sleeve of high carbon steel is used. The draw sleeve can be highly polished to minimize friction and provides an intensifying effect of the ram force over the entire part. Four draw steps are used, with each step followed by an annealing at 925 C for 20 minutes. Results of recrystallization analysis show that the ideal five percent recrystallization is achieved with this process. Author (NSA)

N76-29602# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH Interim Report

Joseph L. Rose and Paul A. Meyer Apr. 1975 131 p refs (Grant AF-AFOSR-2480-73)

(AD-A015291; AFOSR-75-0672TR) Avail: NTIS CSCL 14/2

Analytical models were developed that allow the theoretical ultrasonic reflection to be determined from adhesive bondlines having such flaws as a variation in thickness, density, or modulus gradient in the adhesive or improper surface preparation of the substrate. These models allow the selection of appropriate ultrasonic inspection equipment by indicating the manner in which the reflection will vary. Computer analysis of these models shows that these variations occur in the form of amplitude changes in the time domain, and spectral shifts in the frequency domain. The experimental phase of the program indicates that a variation in the substrate surface preparation does give indications predicted by the models and can be detected ultrasonically using the immersion pulse-echo technique. Author

N76-29603# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

FOAMING CHARACTERISTICS OF MIL-L-7808 TURBINE LUBRICANTS Technical Report, Jun. 1973 - Apr. 1975

H. A. Smith, P. W. Centers, and W. R. Craig Nov. 1975 89 p (AF Proj. 3048)

(AD-A021231; AFAPL-TR-75-91) Avail: NTIS CSCL 11/8

An investigation of MIL-L-7808 lubricant foaming was conducted to: (1) determine the effects of air flow, temperature, simulated altitude conditions, and aeration time on lubricant foaming characteristics; (2) develop test methods for the qualification and lot acceptance testing of MIL-L-7808 lubricants with respect to foaming; and (3) investigate the dispersion characteristics of the anti-foam additive used in some lubricant formulations and the associated changes in lubricant foaming during storage due to loss of anti-foam additive. This investigation has shown: (1) effect of varying test parameters including aeration rates and temperature on lubricant foaming can vary dramatically with different formulations; (2) foaming characteristics of the fourteen lubricants investigated at simulated altitude conditions exhibited the same relative foam characteristics when tested at ground level conditions; (3) lubricant foaming characteristics can change significantly in storage; and (4) the relative ranking of foaming characteristics for the fourteen lubricants investigated was the same for both the dynamic and static test. GRA

N76-29604# Boeing Vertol Co., Philadelphia, Pa.

DEVELOPMENT OF AN AUTOMATED LAYUP SYSTEM FOR MONOFILAMENT FIBER STRUCTURES Final Technical Report, 2 Jan. 1974 - 29 Aug. 1975

E. Frank Sep. 1975 79 p

(Contract DAAJ01-70-C-0049)

(AD-A021670; DRSAV-76-7) Avail: NTIS CSCL 13/8

The ATLAS program was a multiphase program to advance manufacturing technology and fabrication processes for advanced composite materials. Phases I and II covered the development of laying up flat and curved panels. Phase III was for the design of the ATLAS machine. Phase IV covered the fabrication of the report ATLAS. Phase V was the installation and qualification of ATLAS. This report documents the accomplishments of Phase V with its culmination being a demonstration of the ATLAS producing composite components. Author (GRA)

N76-29605# General Electric Co., Cincinnati, Ohio.

AXIAL-CENTRIFUGAL COMPRESSOR PROGRAM, EVALUATION OF AUSFORMED BEARINGS Final Report, 1 Aug. 1972 - 15 Jun. 1975

E. N. Bamberger, John C. Clark, Terrence E. Russel, and Donald A. Smeaton Feb. 1976 121 p refs

(Contract DAAJ02-71-C-0050; DA Proj. 1G1-62207-AA-71)

(AD-A021473; R75AEG473; USAAMRDL-TR-75-55) Avail: NTIS CSCL 13/9

A development program was performed to manufacture, test, and evaluate 35mm diameter ball bearings, using thermomechanically processed rings and balls. The program was subdivided into three main elements: manufacture of test bearings, test facility design and construction, and bearing life testing. All three tasks were completed successfully and are detailed in this report. 35-mm-bore angular contact ball bearings, typical of those used in advanced Army propulsion systems were produced using high-energy-rate forging techniques to form the inner and outer rings, and forward extrusion to produce the ball stock. These bearings were tested in specially designed turbine-driven high-speed test facility, at a speed of 65,000 rpm, at an axial load of 500 lb. and at a temperature of 160F-180F. The initial bearing configuration planned for this test series was found to be inadequate for the above test conditions. A series of iterations was therefore introduced which resulted in a viable test bearing. GRA

N76-29606# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.

HEAT TRANSFER IN TURBINES Final Report, Sep. 1973 - Aug. 1975

Jean F. Louis Nov. 1975 202 p refs

(Contract F33615-74-C-2009; AF Proj. 3066)

(AD-A021256; AFAPL-TR-75-107) Avail: NTIS CSCL 21/5

Experimental and analytical studies of film cooling isothermal effectiveness in subsonic flows are presented. In the experimental study, the shock tunnel was used and coolant flow was injected through slots and patterns of holes in both the streamwise and crosswise directions. The analysis indicates that the momentum ratio of the coolant to the mainflow is a critical parameter in the mixing process of the hot gas with the coolant gas. Further, a single dimension called the effective slot width is defined to determine the area of injection and the mixing surface. GRA

N76-29607# Transportation Systems Center, Cambridge, Mass.

STRATIFIED CHARGE ENGINES Final Report, Oct. - Dec. 1974

Eric M. Withjack Jan. 1976 114 p refs

(PB-251479/2; DOT-TSC-OST-75-56) Avail: NTIS HC $5.50 CSCL 21G

Stratified charge concepts and engines are reviewed with emphasis on the important issues of exhaust emission, fuel economy, and performance. Divided and open chamber designs are discussed. Potential improvements in exhaust emissions and fuel economy are considered in detail. Significant engine programs discussed include those of the Ford, Texaco, and Honda companies. Other variations are described as information is available. Results of programs for the test and evaluation of newly developed and modified conventional engines, particularly engines in test vehicles, are provided. GRA

N76-29608# Stanford Univ., Calif. Dept. of Materials Science and Engineering.

INFLUENCE OF HIGH HYDROSTATIC PRESSURE EXTRUSION ON MECHANICAL BEHAVIOR OF MATERIALS Semiannual Technical Report, 1 Jun. - 31 Dec. 1975

Oleg D. Sherby, John C. Shyne, and Erastus H. Lee Dec. 1975 34 p refs

(Contract N00014-75-C-0923; ARPA Order 2783)

(AD-A021324; SU-DMS-76-T-10; SATR-2) Avail: NTIS CSCL 13/8

Hydrostatic extrusion is a promising new metal working process. It may provide a practical technique to form useful wrought products from materials difficult or impossible to work

by other processes, and it offers the means to develop superior useful properties. This program of research is concerned with the response of a variety of materials to hydrostatic extrusion. A major objective is to relate the microstructure and mechanical properties of extruded materials to the important processing variables, extrusion ratio, extrusion pressure, temperature, and extrusion rate. The experiments fall into two categories: (1) a detailed, systematic investigation of the influence of the processing variables on the properties of several fairly simple materials (pure Fe, Ni, Mg, and Ti: and Cu-30Zn or Cu-10Sn); (2) the utilization of hydrostatic extrusion to optimize the properties of more complex materials chosen for their technological utility (Mg-Li-B for high specific stiffness; Fe-C for high strength, ductility; T-D Nichrome for high temperature strength; Al-Fe, a high conductivity, low density material; NbTi a super conducting alloy). The theoretical portion of the program is devoted to an understanding of extrusion. Elastic-plastic finite-element programs are being considered as a means of analyzing the extrusion process. Such studies are directed towards a complete stress analysis of extrusion and should lead to a better elucidation of the factors influencing the onset of undesirable defects during extrusion. Author (GRA)

N76-29609# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

VACUUM HOT-PRESSING APPARATUS AND TECHNIQUES

Joseph A. Adamski and Normantas Klausutis 11 Nov. 1975 30 p refs

(AF Proj. 5620)

(AD-A021893; AFCRL-TR-75-0582; AFCRL-PSRP-650) Avail: NTIS CSCL 13/8

This report describes the construction and operation of a vacuum hot-pressing apparatus and details of a technique for hot-forging pure and doped alkali halide single crystals to produce high-strength IR windows without degrading optical absorption. Author (GRA)

N76-29610# Columbia Univ., New York. Lubrication Research Lab.

GAS-LUBRICATED POROUS BEARINGS---SHORT JOURNAL BEARINGS, STEADY-STATE SOLUTION

Erh-Rong Wu and Vittorio Castelli Dec. 1975 51 p refs

(Contract N00014-67-A-0108-0021; NR Proj. 062-360)

(AD-A021525; TR-25) Avail: NTIS CSCL 13/9

The governing equations for a short porous bearing are derived by adopting Ocvirk's approximation to the general equations for a finite bearing, which are given in a previous paper. Crank-Nicolson's numerical method and the analytical-numerical technique, which consists of Green function approximation and the local smoothing by integration for a Fourier series, developed in another paper are employed to solve the modified Reynolds equation for a wide range of compressibility number. The solution for a solid-wall bearing is obtained as a special case of a porous bearing. Comparison between two thicknesses of porous layer is included. GRA

N76-29611# Southwest Research Inst., San Antonio, Tex.

ANALYSIS OF FILM THICKNESS EFFECT IN SLOW-SPEED LIGHTLY-LOADED ELASTO-HYDRODYNAMIC CONTACTS. PART 2: MEASUREMENT OF FILM THICKNESSES IN VACUUM Final Report, 1 Jul. 1974 - 15 Jun. 1975

J. C. Tyler, R. D. Brown, H. J. Carper, and P. M. Ku Jan. 1976 132 p refs

(Contract F33615-73-C-5123; AF Proj. 7343)

(AD-A021512; SwRI-RS-632-Pt-2; AFML-TR-74-189-Pt-2) Avail: NTIS CSCL 11/8

This report presents a summary of the second year's effort in a two-year program to study the influence of oil film thickness on bearing-lubricant life expectancy in despin mechanical assembly-type bearings operating in vacuum. Results of elastohydrodynamic film thickness measurements made by the optical interference technique in a SwRI optical tester are presented for seven oils, some of which have been employed in actual space flight hardware. These results show that the special oils formulated for vacuum use behave in a manner similar to ordinary straight mineral oils. Extensive experimental EHD film thickness data were obtained for DMA-type bearings operating in a vacuum and lubricated with various oils, and these results are presented and discussed. These film thickness measurements were made using a race displacement technique developed during the first year's work at SwRI. The measurements show that, in general, lubricant starvation occurs in the bearings with the result that the EHD film thicknesses are less than those predicted by the theoretical equations for flooded EHD lubrication. The results from long-term tests with DMA-type bearings operating in vacuum are also presented. Two bearing failures occurred and these failures are attributed to problems associated with lubrication of the interfaces between the retainer and the other bearing components. Examination of the bearings after test termination reveals that substantially full EHD lubrication (not flooded, but separation of bearing surfaces) at the ball-race contacts apparently prevailed for the duration of the tests. Author (GRA)

N76-29612# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.

MATHEMATICAL MODEL OF FOUR-WHEELED VEHICLE FOR HYBRID COMPUTER VEHICLE HANDLING PROGRAM Interim Report, Mar. 1974 - Oct. 1975

Frederick Jindra Jan. 1976 199 p refs

(Contract DOT-HS-4-00853)

(PB-249907/7; DOT-HS-801-800; Rept-8256-75-167) Avail: NTIS HC $7.50 CSCL 13F

The documentations of the mathematical model of a four wheeled vehicle is presented. Particular attention is given to the derivation of the equations of motion of the sprung and unsprung masses and their subsequent modifications and revisions during the simulation development. Author (GRA)

N76-29613# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.

DEVELOPMENT OF A PROCEDURE FOR MEASURING VEHICLE DEFOGGING ABILITY Final Report, Jun. 1975 - Jan. 1976

C. Bonelli and E. Enserink Jan. 1976 138 p refs

(Contract DOT-HS-5-01208)

(PB-250433/0; DOT-HS-801-816; Rept-8289-75-194) Avail: NTIS HC $6.00 CSCL 13F

The object of the program was to develop a laboratory test procedure which could be used to evaluate the effectiveness of vehicle defrost/defog systems in removing condensation from the interior glazing surfaces of the vehicles. Five automobiles were tested according to a basic procedure partially based on the results of work done by earlier investigations. Results of these tests were used in preparing a recommended test procedure for evaluating defogging systems. GRA

N76-29614# Cornell Univ., Ithaca, N.Y. Sibley School of Mechanical and Aerospace Engineering.

AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE PERFORMANCE AND EMISSIONS OF A HYDROGEN FUELED RECIPROCATING ENGINE Final Report, May 1973 - Jun. 1974

P. C. T. DeBoer, W. J. McLean, J. J. Fagelson, and H. S. Homan Jun. 1974 8 p

(Contract DOT-OS-30113)

(PB-250810/9; DOT-TST-74-25) Avail: NTIS HC $3.50 CSCL 13B

An analytical model has been developed for the nitric oxide emissions and the power output of reciprocating engines fueled by hydrogen. Detailed documentation is provided of the methods used in the model. The results computed are in good agreement with recent experimental results obtained with a conventional engine. The results of the model also are compared with new experimental results from a CFR engine with direct fuel injection. In the latter engine, there was a combustion prechamber with a high turbulence level. The effect of this was found to be a reduction in NO emissions and in power output. Author (GRA)

N76-29615# Shaker Research Corp., Ballston Lake, N.Y.

PNEUMOMECHANICAL CRITICAL SPEED CONTROL FOR GAS TURBINE ENGINE SHAFTS Final Report, May 1974 - Sep. 1975

Warren D. Waldron and Robert S. VanHuysen (Teledyne CAE, Toledo, Ohio) Sep. 1975 148 p refs

(Contract F33615-74-C-2040; AF Proj. 3048)

(AD-A021427; SRC-75-TR-13; AFAPL-TR-75-86) Avail: NTIS CSCL 21/5

The object of the subject program was to further evaluate the application of gas-lubricated foil bearings to control high-speed turbomachine shaft critical speeds and/or amplitude of excursion. The work was intended to expand upon previous efforts by (1) incorporating a simulated H.P. rotor to house the intershaft foil bearings such that various interaction effects could be assessed, and (2) evaluating a tension type foil intershaft bearing. A two rotor test rig which simulated the dynamic characteristics of a two spool aircraft gas turbine engine for testing tension type foil intershaft bearings was designed and constructed. Test results demonstrated that the simulated L.P. rotor could be operated through the region of the second critical speed with the foil intershaft bearings installed, whereas it could not if the foil bearings were not installed. Furthermore, the foil bearings attenuated all rotor amplitudes between the first and second critical speeds. Detrimental interaction effects between high and low speed rotors were not observed. GRA

N76-29616# California Univ., Berkeley. Dept. of Mechanical Engineering.
EXTENSION OF THE LEAN OPERATING LIMIT OF A ROTARY COMBUSTION ENGINE BY HYDROGEN ENRICHED FUEL M.S. Thesis
Joseph Edward Cichanowicz Sep. 1975 113 p refs
(Grant NSF GI-44379)
(PB-249089/4; UCB-ME-75-9; NSF/RA/N-75-216) Avail: NTIS HC $5.50 CSCL 21B

The extension of the Lean Operating Limit (LOL) of internal combustion engines by hydrogen fuel addition was proposed as a viable means of reducing species emissions and increasing thermal efficiency. A review of the literature pertinent to both the particular technique and the thermodynamic principles of fuel-lean combustion is presented. These principles are then used to interpret the results of an investigation in which the LOL of a rotary combustion engine is extended by hydrogen addition. The quantities of hydrogen addition varied from less than one percent of the mass of the gasoline consumption at the lowest air/gasoline ratio to 24 percent at the highest. In terms of overall equivalence ratio, this corresponded to a range from 0.49 to 0.94. The exhaust composition was examined for nitric oxide (NO), carbon monoxide (CO), carbon dioxide (CO2), oxygen (O2), and unburned hydrocarbons (HC). At the ultra-lean equivalence ratios large reductions in CO and NO were noted, but at the expense of an increase in unburned HC. The brake thermal efficiency was observed to be favorably, but not significantly, affected by the fuel-lean combustion conditions. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-29617# Hughes Aircraft Co., Fullerton, Calif.
RELIABILITY METHODOLOGY AND PROCEDURES Final Report, Jan. 1972 - Mar. 1974
George Miller and Alex Furska Apr. 1976 211 p refs
(Contract DOT-FA72WA-2725)
(AD-A025263/5; FAA-RD-76-84) Avail: NTIS HC $7.75 CSCL 14/4

This report is a reliability handbook geared to instructing the user how to implement a reliability program based upon the type of procurement. It lists program content versus type of procurement. Additionally, some fundamental reliability relations are definitized along with some minimal consideration given to redundancy and modeling. Included is a companion document, Reliability Program Plans and Procedure Requirements for Electronic and Associated Support Equipment. This document is basically a specification and contains in specification format the reliability programs identified in the Reliability Handbook. Author

N76-29618# Polish Academy of Sciences, Warsaw.
EPISTEMOLOGICAL FOUNDATIONS OF TECHNICAL DIAGNOSTICS [TEORIOPOZNAWCZE PODSTAWY DIAGNOSTYKI TECHNICZNEJ]
Waldemar Kurowski 4 Dec. 1975 35 p refs In POLISH
Avail: NTIS HC $4.00

A general method of diagnostic procedure is presented which can be valuable in the sphere of methodology. In practice, this procedure can be favorable element for increasing the likelihood of achieving the goal, i.e., making the correct diagnosis with the least effort, particularly in the case of beginning researchers. The need for integration of diverse branches of science is discussed. The evaluation of a mechanical apparatus and the diagnosis of mechanical apparatuses are discussed. The basis of the proposed procedure is the principle that mechanical apparatuses (or subassemblies) can be treated as natural systems which can be represented by cybernetic models which mirror them. Transl. by M.J.S.

N76-29619# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: RELIABILITY LIFE OF LIGHTNING PROTECTION DEVICES UNDER SIMULATED LIGHTNING CONDITIONS Final Report, Jan. - Dec. 1975
Thaddeus L. Regulinski and Jerome T. Dijak Dec. 1975 73 p refs
(Contract DOT-FA72WAI-356)
(AD-A025786/5; FAA-RD-76-92) Avail: NTIS HC $4.50 CSCL 09/1

The experimental design of a reliability life testing program is reported, with its implementation, and with the analysis of generated failure data. Four different types of lightning protection devices were tested under simulated lightning conditions: a Zener diode, a metal oxide varistor, a miniature spark gap, and a semiconductor TransZorb. Nineteen MOV failures and twenty four TransZorb failures were observed out of a total testing sample of 50 and 55 respectively, when subjected to approximately 150 surges of simulated lightning energy. The random variable number of surges-to-failure was modeled by the discrete version of the Weibull probability density function which was tested and accepted under the null hypothesis of the Kolmogorov-Smirnov test at the 0.05 level of significance. The data generated by the Zener diodes and the spark gap devices did not yield conclusive results. Author

N76-29620# Sandia Labs., Albuquerque, N.Mex.
ALGORITHM FOR DETERMINING SURVIVAL PROBABILITIES FOR SYSTEMS WITH REDUNDANT COMPONENTS
C. C. Carson Dec. 1975 15 p refs
(Contract AT(29-1)-789)
(SAND-75-0444) Avail: NTIS HC $3.50

A simple and efficient algorithm for computing the survival probabilities for systems with redundant components (e.g., tactical aircraft in an AAA environment) is presented. The basis for construction of the algorithm and discussion of various aspects of it are included. Author (ERA)

N76-29621# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: THE DESTRUCTIVE BOND PULL TEST Final Report
John Albers Feb. 1976 55 p refs Sponsored in part by DNA and the Navy
(PB-250847/1; NBS-SP-400-18; LC-75-619425) Avail: NTIS HC $4.50 CSCL 14B

The report summarizes the work done at NBS on the destructive bond pull test as applied to small-diameter (approximately 1 mil or 25 micrometer) ultrasonically bonded aluminum wire. The work was performed during the period from 1969 to 1974. The report begins with a brief summary of the calculation of the resolution-of-forces operative in the bond system during the application of the pulling force. Next, comparisons of the theoretical and experimental dependencies of the pull strength on the variables involved in the resolution-of-forces calculation are given. Some of the variables which are not directly involved in this calculation are then considered and their effects on the measured pull strength are presented. The report ends with a sensitivity calculation as to how well the variables must be controlled to maintain the variability of the pull strength to within given limits. Bond pull specifications for large-diameter wire as well as recommended force levels to be used in the application

of the nondestructive bond pull test, both of which have resulted from the pull test work, are considered in the appendices. GRA

N76-29622# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
METHODS DEVELOPMENT FOR NEW NON-DESTRUCTIVE MEASUREMENT OF BOND STRENGTH IN ADHESIVELY BONDED STRUCTURES Final Report, 1 Jan. - 30 Jun. 1975
James A. Seydel Wright-Patterson AFB, Ohio AFML Oct. 1975 60 p refs
(Contract F33615-75-C-5134; AF Proj. 7353)
(AD-A022346; AFML-TR-75-151) Avail: NTIS CSCL 14/2

An automated ultrasonic test system was used to measure the ultrasonic reflectivity of adhesively bonded structures as a function of frequency. An attempt was made to correlate the measurements with adhesive bond strength. GRA

N76-29623# California Univ., Berkeley. Operations Research Center.
TOTAL TIME ON TEST PROCESSES AND APPLICATIONS TO FAILURE DATA ANALYSIS Final Technical Report, 5 Dec. 1972 - 5 Apr. 1975
Richard E. Barlow and Rafael A. Campo Jun. 1975 52 p refs
(Contract F33615-73-C-4078; N00014-69-A-0200-1700; AF Proj. 7071)
(AD-A021667; ARL-TR-75-0195) Avail: NTIS CSCL 14/4

This paper describes new methods for analyzing nonnegative observations. In particular, data plots are constructed that help in model identification and provide information about the failure rate function. The plots allow the analysis of incomplete data. Properties of the plots are discussed and it is explained how to use them in data analysis and in testing for exponentiality. Examples using real data are given that illustrate the useage of the plots. The asymptotic expression of the process induced by the plots is obtained and it is explained how to use it in generating confidence bands and in testing hypotheses. Author (GRA)

N76-29624# Army Missile Command, Redstone Arsenal, Ala. Directorate for Product Assurance.
A SIMULATION STUDY OF METHODS FOR ESTIMATING AVAILABILITY FOR EXPONENTIALLY DISTRIBUTED OPERATING TIMES AND LOG-NORMALLY DISTRIBUTED REPAIR TIMES
Joseph Henry Nordman Nov. 1975 31 p refs
(AD-A021953; QR-75-1) Avail: NTIS CSCL 14/4

This study seeks to determine the superiority of various methods for estimating intrinsic availability from a demonstration test with equal numbers of operating times and repair times. A total of 31 methods are investigated. The parameters used to simulate availabilities are for exponentially distributed operating times and log-normally distributed repair times and are in a range that is of interest to users of modern weapon systems. The conclusion is reached that no advantage is possible for one estimating procedure as opposed to another. As a result of the knowledge gained in this study, a set of confidence graphs useful for designing availability tests were constructed. GRA

N76-29625# Florida State Univ., Tallahassee. Dept. of Statistics.
TECHNIQUES FOR ANALYZING MULTIVARIATE FAILURE DATA Interim Report
Richard E. Barlow and Frank Proschan Dec. 1975 23 p refs
(Contract AT(49-24)-0147; Grant AF-AFOSR-2581-74; AF Proj. 9769)
(AD-A020303; FSU-Statistics-M364; TR-58) Avail: NTIS CSCL 12/1

New multivariate techniques for analyzing multivariate life test data are introduced. The hazard gradient is estimated using the multivariate piecewise exponential distribution model. An example based on caterpillar tractor data is analyzed. Iso-probability contours are used to analyze joint distribution structure. Author (GRA)

N76-29626# Rome Air Development Center, Griffiss AFB, N.Y.
RELIABILITY ACQUISITION COST STUDY, 2 Final Technical Report
R. E. Schafer, G. T. Mead, and J. E. Angus Nov. 1975 91 p refs
(Contract F30602-74-C-0139; AF Proj. 5519)
(AD-A020457; RADC-TR-75-270) Avail: NTIS CSCL 14/4

This report presents the results of a quantitative investigation into the relationship between reliability expenditures (costs) and reliability in the development phase for ground systems. The reliability program was divided into three phases: design, parts, and evaluation. In particular, three areas were addressed. First, quantitative relationships were developed for predicting reliability costs, by phase, of the reliability program and total cost, based on commonly available independent variables. Second, prediction models were developed for achieved reliability. Next, reliability gain (due to expenditures in each phase) was studied and models were developed for estimating reliability gain: total and by phase. Finally, optimal allocation of reliability resources was investigated. Models were developed and a solution found. The data base consisted of ten systems of relatively recent vintage. The data were subjected to an evaluation for validity and factors affecting reliability and reliability expenditures which could only confuse the results were normalized out of the data. GRA

N76-29627# Naval Air Development Center, Warminster, Pa. Navigation Lab.
DESIGN AND ANALYSIS OF FIXED TIME RELIABILITY DEMONSTRATION TESTS
J. Adelsberg 1 Nov. 1975 101 p refs
(AD-A020947; NADC-75265-60) Avail: NTIS CSCL 14/4

The principal reliability demonstration test methods are identified and their characteristics reviewed. The use of a graphic procedure for the design and analysis of fixed time tests is discussed and examples illustrating application to the design of Classical, Bayes and Hybrid plans are given. The graphic procedure is also applied to evaluate the effect on the Bayes posterior risks as a function of different prior distributional characteristics and to make comparisons between the different test methods. A technique for constructing the operating characteristic (O.C.) curve for any fixed time test is presented and the O.C. data for various test plans are tabulated. GRA

N76-29628# Air Force Systems Command, Wright-Patterson AFB, Ohio.
EXPERIMENTS WITH THE STATISTICAL TESTING OF THE FATIGUE LIFE OF MODEL SPECIMENS
Jan Drexler 27 Jan. 1976 12 p refs Transl. into ENGLISH from Zpravodaj Vzlu (Czechoslovakia), no. 1, 1973 p 27-31
(AD-A020348; FTD-ID(RS)I-2458-75) Avail: NTIS CSCL 14/2

This article provides practical information obtained by using graphonumerical statistical tests of the results of fatigue tests on model specimens of aircraft structures. The concrete case of the evaluation of the service life of tested specimens on Weibull probability paper, supplemented by a nomogram, for determining the parameters of shape and position, is presented. GRA

N76-29629# Naval Postgraduate School, Monterey, Calif.
MULTI-PHASE-MISSION RELIABILITY OF MAINTAINED STANDBY SYSTEMS Final Report
Merlin G. Bell Dec. 1975 55 p refs
(NR Proj. 042-300)
(AD-A021823; NPS-55EY75121) Avail: NTIS CSCL 14/4

In a phased mission the functional organization of the system changes at selected times which mark the boundaries of the phases of the mission. Existing methods for analysis of phased missions are modified and extended to permit determination of the reliability of systems which are maintained during a standby period, called the operational readiness phase, during which the system functions solely to maintain its readiness for a later period of active operations. This mode of operation is frequently exhibited by strategic weapon systems and safety devices. These results are then extended to systems which perform complex multi-objective missions to permit assessment of system performance at levels intermediate between total failure and total success. GRA

N76-29630# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
DUANE'S RELIABILITY GROWTH MODEL AS A NONHO-

MOGENEOUS POISSON PROCESS Final Report
John Donelson, III Dec. 1975 95 p refs
(AD-A020165; P-1162; IDA/HQ-76-18012) Avail: NTIS CSCL 12/1

A model of Duane's cumulative-failure-rate is presented that interprets the counting process N(t) as a Nonhomogeneous Poisson Process (NHPP) having a mean-value function. The objective in this paper is to present rigorous derivations of the procedures for estimating parameters, forecasting failure rates, and testing hypotheses for the NHPP model of the occurrence of failures.
GRA

N76-29631# Army Missile Command, Redstone Arsenal, Ala. Directorate for Product Assurance.
CONFIDENCE GRAPHS USEFUL FOR DESIGNING AVAILABILITY TESTS
Joseph Henry Nordman 17 Nov. 1975 27 p refs
(AD-A021751; QR-75-2) Avail: NTIS CSCL 14/4

This report gives availability confidence graphs useful for designing availability tests. The parameters used to simulate availabilities are for exponentially distributed operating times and log-normally distributed repair times and are in a range that is of interest to users of modern weapon systems, particularly those weapon systems of interest to the U.S. Army Missile Command.
Author (GRA)

N76-29632# RAND Corp., Santa Monica, Calif.
MEASUREMENT OF TECHNOLOGICAL INNOVATION BY FIRMS
Alvin J. Harman Sep. 1975 30 p refs Presented at the 3d Econometric Soc. World Congr., Toronto, Aug. 1975
(AD-A021712; P-5496) Avail: NTIS CSCL 13/6

The specific objective of this paper is to describe the preliminary results of our theoretical model development and our approach to measuring product quality change in the computer and machine tool industries.
GRA

N76-29633# Illinois Univ., Urbana. Coordinated Science Lab.
ON THE EXISTENCE OF COMBINATIONAL NETWORKS WITH ARBITRARY MULTIPLE REDUNDANCIES
James E. Smith and Gernot Metze Oct. 1975 32 p refs
(Contract DAAB07-72-C-0259)
(AD-A021661; R-692; UILU-ENG-75-2227) Avail: NTIS CSCL 14/4

Redundancy involving a single line is fairly well understood. However, little is known about multiple-line redundancies for which any proper subset is irredundant. This report provides some tools for studying such redundancies. It presents several new examples of multiple redundancies and proves by a constructive method that redundancies of all multiplicities exist.
Author (GRA)

N76-29634# Stanford Univ., Calif. Dept. of Statistics.
RELIABILITY ASSESSMENT FOR HIGHLY RELIABLE SYSTEMS Final Report, 15 Jun. - 14 Oct. 1975
M. Vernon Johns, Jr. Nov. 1975 58 p refs
(Grant DAHC04-75-G-0174)
(AD-A021498; ARO-13388.1-M) Avail: NTIS CSCL 14/4

Research detailed in the bulk of this report was motivated by a critical inquiry into the characteristics of three methods for reliability assessment proposed by personnel of the Rock Island Arsenal. These three procedures had been developed somewhat empirically and an evaluation of their appropriateness and precision in the context of application to highly reliable systems appeared to be desirable. In the course of this evaluation it was found necessary to develop a theoretically sound reliability model and an accurate confidence bound procedure to form a basis for the required comparisons. A detailed discussion of the performance of the three methods in light of the results developed in this report is presented.
Author (GRA)

N76-29635# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PROBABILITY-BASED MODELS FOR THE FAILURES DURING BURN-IN PHASE Interim Report
Paul B. Moranda Nov. 1975 18 p refs Presented at the Joint Natl. Meeting ORSA/TIMS, Las Vegas, Nev., 17-19 Nov. 1975
(Contract F44620-74-C-0008; AF Proj. 9769)
(AD-A020706; AFOSR-76-0124TR) Avail: NTIS CSCL 14/4

Two models which were developed to describe the software error detection process have applicability to the burn-in phase of hardware failure; the failure rate for the :next: error is either proportional to the current number of remnant errors (de-eutrophication model) or decreases to a value which stands in a fixed ratio to its prior value (geometric de-eutrophication model). Estimates of the mean time to failure and the degree of completeness of testing are made on the observed time separations by maximum likelihood. The results of a study on the variances and efficiencies and robustness of the two models are presented.
GRA

N76-29636# University of South Florida, Tampa. Dept. of Mathematics.
ON THE BEHAVIOR OF PRIOR DISTRIBUTIONS FITTED TO FAILURE DATA Interim Report
J. J. Higgins and C. P. Tsokos 1 Sep. 1975 29 p refs
(Grant AF-AFOSR-2895-76; AF Proj. 9769)
(AD-A020677; AFOSR-76-0112TR) Avail: NTIS CSCL 14/4

Equipment mean time between failures (MTBF) is assumed to be a random variable, the probability density function of the MTBF being called the prior density. The method of moments procedure for fitting the uniform prior density to failure data is given. The goodness of fit of the uniform prior is compared to the goodness of fit of the inverted gamma prior for actual failure data. Posterior producer's and consumer's risks for the uniform and inverted gamma priors are compared in the context of Bayesian reliability demonstration tests. It is shown that the corresponding posterior risks for the two priors can be significantly different even when the two priors fit the data equally well.
GRA

N76-29637# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
FAMILIES OF DISTRIBUTIONS WITH POSITIVE MEMORY DERIVED FROM THE MEAN RESIDUAL LIFE FUNCTION
Eginhard J. Muth Oct. 1975 46 p refs
(Grant AF-AFOSR-2605-74; AF Proj. 9749)
(AD-A020870; AFOSR-76-0020TR; RR-75-5) Avail: NTIS CSCL 14/4

The probability law of a positive random variable with finite mean is uniquely determined by the mean residual life function. This function is useful as an indicator of wearout and similar mechanisms. The amount of memory of a distribution is defined and positive memory is related to a decreasing mean residual life function. The properties of the mean residual life function and the hazard function are compared. Several distribution models are derived based on a simple analytical form of a decreasing mean residual life function.
GRA

N76-29638# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
RELIABILITY ANALYSIS FOR COMPLEX, REPAIRABLE SYSTEMS
Larry H. Crow Dec. 1975 40 p refs
(DA Proj. 1R7-65706-M-541)
(AD-A020296; AMSAA-TR-138) Avail: NTIS CSCL 14/4

The reliability of a complex system that is repaired (but not replaced) upon failure will often depend on the system chronological age. If only minimal repair is made so that the intensity (instantaneous rate) of system failure is not disturbed, than a nonhomogeneous Poisson process may be used to model this age-dependent reliability. This paper considers the theoretical and practical implications of the nonhomogeneous Poisson process model for reliability, and gives estimation, hypotheses testing, comparison and goodness of fit procedures when the process has a Weibull intensity function. Applications of the Weibull model in the field of reliability and in other area are discussed.
Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-29639 Wisconsin Univ., Madison.
THE DYNAMIC RESPONSE OF SPINNING CROSS-PLY LAMINATED CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Stuart Samuel Gassel 1976 152 p
Avail: Univ. Microfilms Order No. 76-10659

A new dynamic shell theory is developed to study cross-ply laminated circular cylindrical shells. The analytical model is an improved theory which includes the effects of heterogeneous shear deformation and rotary inertia as well as constant spin, a uniform initial membrane state of stress and viscous damping. The character of the derivation is such that the basic equations, although applicable to laminates with diverse material and geometric properties, possess a desirous simplicity. In fact, for a shell consisting of an arbitrary number of layers only five displacement variables are required to describe the response. In addition, the equations may be reduced to the equations of generally accepted shell models. This allows for convenient comparison. The theory is employed to construct an exact solution for the free and forced vibration of a simply supported, finite length cylinder, subjected to general time dependent surface loads. Dissert. Abstr.

N76-29640 Georgia Inst. of Tech., Atlanta.
ON THE PARAMETRIC EXCITATION OF A TENSIONED SHEET WITH AN EDGE CRACK Ph.D. Thesis
Som P. S. Virk 1975 122 p
Avail: Univ. Microfilms Order No. 76-15598

Results of an experimental and analytical investigation of the parametric excitation of a tensioned sheet with an edge crack are described. The free vibration and static tensile buckling are studied as special cases. The effect of crack length on the free vibration, static tensile buckling and dynamic behavior is emphasized. The homogenous, linear governing differential matrix equations for the dynamic stability problem are obtained by using assumed modes in Lagrange's Equations. The special cases of free vibration and tensile buckling are obtained by setting certain quantities to zero. The free vibration analytical results obtained by the use of a finite element method correlate well with the experimental results. The finite element method is also used for the analysis of the initial nonuniform stress state. Dissert. Abstr.

N76-29641 California Univ., Berkeley.
EXPERIMENTAL AND ANALYTICAL STUDIES OF HYSTERETIC BEHAVIOR OF REINFORCED CONCRETE RECTANGULAR AND T-BEAMS Ph.D. Thesis
Shao-yeh Marshall Ma 1975 419 p
Avail: Univ. Microfilms Order No. 76-15301

An investigation was conducted of the inelastic behavior of the critical region that may develop in a beam near its connection with the column of a reinforced concrete ductile moment-resisting space frame when subjected to severe earthquake motions. A series of nine cantilever beams, designed according to seismic codes, and representing half-scale models of the lower story girder of a 20-story ductile moment-resisting reinforced concrete office building, was tested to study the following: (1) effect of slab by testing T-beams with a top slab width equal to the effective width specified by the ACI Code; (2) effect of relative amounts of top and bottom reinforcement by varying the amounts of bottom reinforcement; (3) effect of supplementary ties by providing hairpin ties around main bars not restrained by the corners of stirrup ties; (4) effect of high shear force by varying the shear-span ratio; and (5) effect of loading sequences. Dissert. Abstr.

N76-29642 Texas Univ., Austin.
STRENGTH AND BEHAVIOR OF POST-TENSIONED FLAT PLATES WITH UNBONDED TENDONS Ph.D. Thesis
Roongroj Hemakom 1975 289 p
Avail: Univ. Microfilms Order No. 76-14463

The strength and behavior of nine-panel flat plates with unbonded tendons through the elastic and inelastic range, and under the collapse load, were studied. Two nine-panel 32.5 ft. x 32.5 ft. x 2.75 in. concrete model slabs with 16-8 in. x 8 in. columns @ 10 ft. centers were constructed and tested. With minimum bonded reinforcement of 0.15 percent of the column strip provided as top steel in the slab near the column, the cracks were very well controlled even up to loads approaching ultimate load. Placement of this amount of bonded reinforcement within a distance extending 1.5ft. from the edges of the column provided the control of cracking and contributed to the flexural strength. Dissert. Abstr.

N76-29643# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
AN ITERATIVE LAYERED ELASTIC COMPUTER PROGRAM FOR RATIONAL PAVEMENT DESIGN Final Report
Yu. T. Chou Feb. 1976 70 p refs
(Contract DOT-FA73WAI-377; DA Proj. 4A7-62719-AT-04; DA Proj. 4A1-61102-B-52E)
(AD-A024334/5; FAA-RD-75-226) Avail: NTIS HC$4.50 CSCL 13/2

A linearly layered elastic computer program was expanded and modified to include an iterative procedure for rational pavement design. Pavement response to multiple loads can be predicted using the nonlinear moduli of pavement materials. The new program is designated CHEVIT. The program uses the iterative procedures to determine the nonlinear moduli of pavement materials and then computes the stresses and strains in the pavement under a single wheel load by the Burmister linear layered elastic computational method. The principle of superposition is used to account for multiple wheel loads. For completeness, the CHEVIT program also accounts for linear problems and single loads. Results computed by the iterative layered elastic program were compared with those computed by the nonlinear finite element program. Modifications and improvements to the iterative layered program were made accordingly. Comparisons of computed and measured stresses and displacements are presented along with flow charts and an input guide. Example problems and illustration of the use of the input guide are also presented. Author

N76-29644*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
SEVERAL INTACT OR BROKEN STRINGERS ATTACHED TO AN ORTHOTROPIC SHEET WITH A CRACK
K. Arin Jul. 1976 22 p refs
(Grant NsG-1178)
(NASA-CR-148601) Avail: NTIS HC $3.50 CSCL 13M

Several intact or broken stringers which are continuously attached to a cracked orthotropic sheet through an adhesive are considered. The effect of orthotropy on the stress intensity factors is investigated. The stringers are assumed to be partially debonded due to high stress concentrations. The shear stress distribution between the stringers and the plate and the stress intensity factors are obtained from an integral equation which represents the continuity of displacements along the bond lines. Author

N76-29645# Polish Academy of Sciences, Warsaw.
ONE DIMENSIONAL WAVES IN NON-ELASTIC MEDIUMS [JEDNOWYMIAROWE FALE W OSRODKACH NIESPREZYSTYCH]
Witold Kosinski 27 Oct. 1975 82 p refs In POLISH
Avail: NTIS HC $5.00

The concept of particular curves, i.e., waves of acceleration and shock waves is described along with the concept of internal parameters as necessary magnitudes for describing the behavior of nonelastic mediums. Acceleration waves are analyzed in detail and the problem of shock wave propagation and behavior is considered. Two sample problems are worked: an acceleration wave in a nonlinear viscous-elastic material and a shock in an elastic-viscous-plastic medium. It is shown that the behavior of acceleration waves in nonlinear elastic, viscous-elastic, aging elastic, and even elastic-viscous-plastic bodies can be in certain situations qualitatively identical. Author

N76-29646# Polish Academy of Sciences, Warsaw.
ANALYSIS OF PLATES WITH A GIVEN DISCRETE STRUCTURE [ANALIZA PLYT O DANEJ STRUKTURZE DYSKRETNEJ]
Jacek Bauer 14 Nov. 1975 105 p refs In POLISH
Avail: NTIS HC $5.50

The utilization of a discrete description for the analysis of a construction with regular structure is discussed. Specific considerations are limited to the statistics of thin compressed plates weakened by regularly dispersed openings, but this method can also be successfully used for very compact disks, envelopes, or three dimensional problems. The problem of constructional statistics is reviewed. A geometric description of a plate with a discrete structure is given, a differential-variational problem is formulated and solved for the plate and numerical solutions of an element of the first order and a plate with the form of a regular polygon with trapezoidal openings are presented. Author

N76-29647# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON THE DYNAMIC RESPONSE AND FAILURE OF STIFFENED AND UNSTIFFENED CYLINDRICAL SHELLS UNDER AXIAL IMPACT
G. Maymon (Ministry of Defence, Israel) and A. Libai Mar. 1976 45 p refs
(TAE-275) Avail: NTIS HC $4.00

Time history of the expected values of stresses and radial displacements in imperfect, closely spaced, stiffened cylindrical shells subjected to axial impact is analyzed. The analysis is based on Donnell type equations for the dynamics of stiffened (and unstiffened) cylindrical shells with assumed statistical distributions of the initial imperfections, leading to a statistical description of the response. An engineering oriented failure criterion is utilized for practical purposes. A specially constructed computer program is utilized for presenting several numerical parametric studies of axially stiffened shells. Of interest is the apparent existence of an optimal size of stiffening. Author

N76-29648# Southwest Research Inst., San Antonio, Tex.
ENERGY SOLUTIONS FOR PREDICTING DEFORMATIONS IN BLAST-LOADED STRUCTURES Technical Report, Jan. - Sep. 1974
P. S. Westine and W. E. Baker Nov. 1975 34 p refs
(Contracts DAAD05-74-C-0751; DAAA15-75-C-0083; DA Proj. 5751264)
(AD-A022333; EM-CR-76027; TR-6) Avail: NTIS CSCL 19/4

Equations are developed for predicting permanent deformations of structural elements, based on energy solutions. The equations apply to either impulsive or quasi-static response of simple structures, beams and plates. Some solutions are compared to literature data. GRA

N76-29649# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
COLD WEATHER CONSTRUCTION MATERIALS. PART I. REGULATED-SET CEMENT FOR COLD WEATHER CONCRETING
B. J. Houston and G. C. Hoff Dec. 1975 30 p refs
(AD-A021658; CRREL-SR-245) Avail: NTIS CSCL 13/3

The U.S. Army carries on construction projects in localities such as Alaska, the northern tier of the United States, northern Europe, Greenland and other arctic sites where the concrete placing season is shortened considerably by the cold climate. At ambient temperatures below 50 F, concreting operations become considerably more expensive since U.S. Army Corps of Engineers specifications require freshly mixed and placed concrete to be protected from ambient temperatures. This report covers part of an investigation to locate and evaluate existing and new cementing materials that allow concrete to be placed at ambient temperatures as low as 15 F. A newly developed cement termed regulated-set cement, which is an accelerated set cement, appeared to have great promise and was selected for study in this stage of the investigation. Both mortars and concretes made with regulated-set cement were studied with the following results: (1) the longer freshly mixed regulated-set cement concrete remains above freezing before exposure to below freezing temperatures the greater the subsequent early strength gain; however, considerable strength gain was exhibited by specimens exposed at 15 F immediately after casting. Specimens protected one hour before exposure exhibited almost as much strength at 28 days age as specimens cured at 70 + or - 3 F for the full time; and (2) the heat development in 3-, 6-, and 12-in.-thick slabs exposed at 15 F immediately after casting peaked in one to two hours at 46.5, 58 and 69 F, respectively, and remained above freezing long enough to gain considerable strength. GRA

N76-29650# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FRACTURE MECHANICS ANALYSIS OF AN ATTACHMENT LUG Interim Technical Report, May - Oct. 1974
Oscar Orringer Jan. 1976 92 p refs
(Contract F33615-74-C-3063; AF Proj. 1367)
(AD-A021280; ASRL-TR-177-1; AFFDL-TR-75-51) Avail: NTIS CSCL 01/3

This report documents a finite-element analysis procedure for computation of Mode 1 and Mode 2 stress intensity factors associated with a sharp crack in an attachment lug detail. The procedure is a complete FORTRAN-4 program which generates and parametrically analyzes the lug, based on designer-oriented input data. The formulation of a special crack-containing element is reviewed and its performance is summarized. A detailed description of the lug analysis procedure covers the physical problem, modeling, program flow and options, input/output conventions, execution times and limitations which must be observed. Results from example analyses of some attachment lugs are presented. GRA

N76-29651# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COHERENCE FUNCTIONS USED TO DEFINE SOURCES OF AIRBORNE ANTENNA VIBRATION Final Report, Apr. - Aug. 1975
R. E. Thaller and Jerome Pearson Dec. 1975 48 p refs
(AF Proj. 1472)
(AD-A021483; AFFDL-TR-75-143) Avail: NTIS CSCL 09/5

Conditional coherence functions are used in a practical mechanical vibration problem to determine which of several possible inputs are the major causes of vibration of an airborne antenna. Pairwise, multiple, and multiple conditional coherence spectra are derived from flight vibration data. The vibratory inputs causing several important antenna responses are identified despite correlations between inputs. These inputs offer the highest potential for reducing the antenna vibration by isolation or decoupling. The results also provide a measure of the vibration reduction which can be achieved by eliminating these inputs. GRA

N76-29652# Transportation Research Board, Washington, D.C.
TEST PROCEDURES FOR CHARACTERIZING DYNAMIC STRESS-STRAIN PROPERTIES OF PAVEMENT MATERIALS
Bernard F. Kallas 1975 49 p refs
(PB-251486/7; TRB/SR-162; ISBN-0-309-02468-4) Avail: NTIS HC $4.00 CSCL 14B

Dynamic testing procedures for evaluating the resilient moduli of highway materials that have been found to give reasonable results are examined. Topics discussed include the following: Fundamental considerations; Specimen preparation and compaction processes; Resilience testing of unstabilized soils; Complex modulus testing of pavement materials; Flexural modulus testing of stabilized materials; Indirect tensile test; Testing for shear modulus and damping of soils by the resonant column method; Simplified test method for determining the resilient modulus of cohesive soils. Author (GRA)

N76-29653# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
INVERSE PROBLEM FOR A VIBRATING BEAM
Victor Barcilon Nov. 1975 23 p refs
(Contract N00014-76-C-0034; NR Proj. 041-476)
(AD-A021437) Avail: NTIS CSCL 20/11

The problem of inferring the flexural rigidity and density of a beam from its eigenfrequencies is considered, for the particular case in which one end is clamped. It is shown that three spectra associated with three sets of boundary conditions at the

other end are required in order to insure a unique solution of the inverse problem. Furthermore, it is shown that this data set is equivalent to the information contained in the time history of the displacement and slope of the free end of the beam set in motion by a concentrated impulse. GRA

N76-29654# Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
FLY ASH AS FILL AND BASE MATERIAL IN ARKANSAS HIGHWAYS Final Report
Sam I. Thornton and David G. Parker Oct. 1975 109 p refs Sponsored in part by DOT and Arkansas State Highway Dept. (Proj. 43)
(PB-250480/1) Avail: NTIS HC $5.50 CSCL 13C

Fly ash, similar to that to be produced in Arkansas, reacts chemically like quick lime, generating heat and possessing self hardening characteristics. Reactivity of the ash may be due to the relatively high CaO content. Two Arkansas soils, an organic clay and a sand (classified OH and SP-SM by the Unified system) were stabilized with the fly ash. The fly ash used in this study, was produced from Wyoming low sulfur coal and contains 20% CaO. The engineering properties of this fly ash, fly ash-soil mixtures, and mixtures with lime and Portland Cement are reported. GRA

N76-29655# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONTAINMENT STRUCTURES VERSUS SUPPRESSIVE STRUCTURES Final Report
Norris J. Huffington, Jr. and Struan R. Robertson Feb. 1976 38 p refs Supersedes BRL-IMR-190
(DA Proj. 1W1-61102-AH-43)
(AD-A021973; BRL-MR-2597; BRL-IMR-190) Avail: NTIS CSCL 13/13

As part of a study of the suppressive structure concept, analyses of the large deflection, elastoplastic response of two configurations (a hemispherical shell and a cylindrical shell with closed ends) subjected to internal blast were performed. These blast and fragment containment structures may be regarded as limiting cases of suppressive structures and the results obtained are believed to constitute useful baseline data for evaluating efficiency of suppressive structure designs. The results indicate that these simple structures can provide total containment of fragments and blast for significantly less weight and cost than a corresponding vented suppressive structure. Suggestions regarding more practical containment/suppressive structural configurations are included. Author (GRA)

N76-29656# Advisory Group for Aerospace Research and Development, Paris (France).
STRUCTURAL IDENTIFICATION ON THE GROUND AND IN FLIGHT INCLUDING COMMAND AND STABILITY AUGMENTATION SYSTEM INTERACTION
Jun. 1976 57 p refs Partly in ENGLISH and FRENCH Presented at 42nd Struct. and Mater. Panel Meeting, Ottawa, Apr. 1976 (AGARD-R-646) Avail: NTIS HC $4.50

Papers are presented which deal with vibration testing of aircraft and rocket vehicles, flutter analysis, particularly of the MRCA aircraft, digital techniques for flutter analysis, and interactions between aircraft structures and the command and stability augmentation system of the MRCA. For individual titles, see N76-29657 through N76-29660.

N76-29657 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NEW STRUCTURAL TESTING METHODS BASED ON NON-APPROPRIATED EXCITATION
Gerard Piazzoli *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 1-6 refs In FRENCH; ENGLISH summary (For availability see N76-29656 20-39)

After recalling the classical methods for determining the vibratory characteristics of an aircraft or rocket structure by a test with appropriated excitation, the paper presents two new methods that do not deliver appropriation. In the Angelini method, independent excitations are located at significant points, that may number up 20 for a military aircraft with external stores. In the Dat-Meurzec method, the structure transfer functions obtained from a single, localized excitation configuration are smoothed; it is particularly convenient for the study of rockets. Both methods were implemented with the computer installed in the ONERA mobile laboratory. They permit a considerable gain of time, and give results comparable to those provided by the classical method. Author

N76-29658 Air Force Flight Test Center, Edwards AFB, Calif.
DIGITAL TIME SERIES ANALYSIS OF FLUTTER TEST DATA
Russell W. Lenz and David A. Foreman *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 7-24 refs (For availability see N76-29656 20-39)

A minicomputer based digital time series analysis system is used at the Air Force Flight Test Center to provide near real time estimates of modal parameters during flight flutter testing. Since the test data acquired often contains noise which distorts the transfer function or autospectrum results, data smoothing algorithms are employed. These algorithms, as well as algorithms for performing multimodal analyses, have been found to be useful when analyzing noisy aircraft data. Use of digital techniques has been beneficial both in terms of saving time and in improving accuracy when compared with more traditional flutter testing approaches. Author

N76-29659 British Aircraft Corp., Warton (England).
INFLIGHT FLU[illegible]ER IDENTIFICATION OF THE MRCA **c05**
D. K. Potter and A. Lotze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich) *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 25-39 refs (For availability see N76-29656 20-39)

Flutter investigations were performed prior to flight testing and during flight flutter testing of the MRCA. Because the aircraft is equipped with fast responding power control systems which could produce undesirable structural motion, flutter investigations had to be accomplished with consideration of the command and stability augmentation system (CSAS). Analysis and test results for structural mode coupling with the CSAS are demonstrated for the aircraft on ground which proved to be the condition for the lowest stability margin. It was shown that there is practically no influence of CSAS on flutter behavior. The flutter speed with the lowest flutter margin was predicted for an antisymmetrical taileron mode which is modified by fuselage influences. The coupling mechanism of this mode was investigated and the effect of apex balance weight on the taileron inboard leading edge was demonstrated. Author

N76-29660 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
INTERACTION BETWEEN AIRCRAFT STRUCTURE AND COMMAND AND STABILITY AUGMENTATION SYSTEM **c08**
O. Sensburg *In* AGARD Structural Identification on the Ground and in Flight Including Command and Stability Augmentation System Interaction Jun. 1976 p 41-53 refs (For availability see N76-29656 20-39)

The multi role combat aircraft - MRCA - has a fly-by-wire control system and automatic stabilization. The sensors for the command and stability augmentation system - CSAS - are attached to the flexible aircraft structure and may therefore pick up signals which are detrimental to the stability. This paper describes the method which was used on the MRCA to avoid CSAS- structural mode coupling effects. Author

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-29661*# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SURVEY OF CAPEWEED DISTRIBUTION IN AUSTRALIA IN RELATION TO CLIMATE, LANDFORMS, SOIL TYPES AND MANAGEMENT PRACTICES
Graham W. Arnold and Frank R. Honey, Principal Investigators [1975] 7 p Sponsored by NASA ERTS
(E76-10387; NASA-CR-148167) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. The ground measurements of the reflectivity of the capeweed species shows significant variation from the pasture species measured. The variation in the capeweed signature, as a function of the flower cover indicates that the optimum time for a survey would be when the capeweed is at peak flowering.

N76-29662*# Delaware Univ., Newark. Coll. of Marine Studies.
LANDSAT OBSERVATIONS OF OCEAN DUMP PLUME MOVEMENT AND DISPERSION
V. Klemas, Principal Investigator, G. R. Davis, and R. Henry 26 Jul. 1976 3 p ERTS
(Contract NAS5-20983)
(E76-10415; NASA-CR-148277) Avail: NTIS HC $3.50 CSCL 13B

The author has identified the following significant results. Eighteen LANDSAT images were analyzed to study the dispersion and movement of ocean dump plumes thirty-eight miles southeast of Cape Henlopen, Delaware, at the disposal site for waste discharged from a plant producing titanium dioxide. Long visual persistence was explained by the formation of a suspended ferric floc. Spectrometric measurements indicate that upon combining with sea water the acid waste develops a strong reflectance peak in the band 0.55 to 0.60 micron region, resulting in a stronger contrast in the MSS band 4 than the other bands. Predominant direction of movement of the waste plumes was to the southeast. Average drift velocity for surface drogues and the waste plumes was about 0.5 knots. The water at the test site was highly stratified and stable in the summer and nearly homogenous in the winter.

N76-29663*# Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka).
REMOTE SENSING FROM ARTIFICIAL EARTH SATELLITES
A. T. M. Silva and S. D. F. C. Nanayakkara, Principal Investigators [1975] 12 p Sponsored by NASA ERTS
(E76-10421; NASA-CR-148295) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-29664*# Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka).
INVESTIGATION OF THE AGRICULTURAL RESOURCES IN SRI LANKA Technical Report, Aug. 1975 - Jun. 1976
A. T. M. Silva, S. D. F. C. Nanayakkara, and L. S. K. B. Herath, Principal Investigators Jun. 1976 14 p Sponsored by NASA ERTS
(E76-10422; NASA-CR-148298) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. It is observed that LANDSAT data is easily adaptable to photogrammetric techniques. With such adaptations, revision of topographic or thematic maps can be performed at very little cost. Revision of maps up to scale 1:100,000 (or better) can be performed. The LANDSAT image has definite advantages over the standard methods in areas of extensive development where the synoptic view of the LANDSAT image offers the required control in the form of distant mapped data in one frame.

N76-29665*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 Feb. - 11 May 1976
John W. Hannah (Brevard County Planning Dept., Titusville, Fla.), Garland L. Thomas (Brevard County Planning Dept., Titusville, Fla.), and Fernando Esparza, Principal Investigators 11 May 1976 19 p ref ERTS
(Contract NAS5-20907)
(E76-10435; NASA-TM-X-72965; BCPD-L2-5) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-29666*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Final Report, 1 Jul. 1973 - 30 Jun. 1975
John W. Hannah, Garland L. Thomas, Principal Investigators, and Fernando Esparza (NASA. Kennedy Space Center) 25 Aug. 1975 113 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order C-30281-A)
(E76-10436; NASA-CR-139189; BCPD-E-8) Avail: NTIS HC $5.50 CSCL 08B

There are no author-identified significant results in this report.

N76-29667*# National Marine Fisheries Service, Bay Saint Louis, Miss.
LANDSAT FOLLOW-ON EXPERIMENT: GULF OF MEXICO MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 31 Oct. 1975 - 31 Jan. 1976
Kenneth Savastano, Principal Investigator, Andrew J. Kemmerer, and Kenneth Faller (Natl. Space Technology Labs., Bay Saint Louis, Miss.) Feb. 1976 37 p refs ERTS
(NASA Order S-54114)
(E76-10437; NASA-CR-148545; SEFC-Contrib-442; MARMAP-Contrib-111; Rept-3) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. The most significant achievement realized is the successful mapping of high probability fishing areas from LANDSAT MSS data for two Mississippi Sound missions.

N76-29668*# Tennessee Univ., Knoxville. Dept. of Geography.
THE VERIFICATION OF LANDSAT DATA IN THE GEOGRAPHICAL ANALYSIS OF WETLANDS IN WESTERN TENNESSEE Research Report, 21 Jul. 1975 - 21 Apr. 1976
John B. Rehder and Dale A. Quattrochi, Principal Investigators 21 Apr. 1976 59 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS8-31143)
(E76-10438; NASA-CR-144307) Avail: NTIS HC $4.50 CSCL 05B

There are no author-identified significant results in this report.

N76-29669*# Columbia Univ., New York.
APPLICATION OF LANDSAT DATA TO AGRICULTURAL RESOURCE PROBLEMS WITH EMPHASIS ON THE NORTH AMERICAN GREAT PLAINS Progress Report
Kempton Webb, Colin J. High, and Jerry C. Coiner, Principal Investigators 28 Feb. 1976 34 p refs ERTS
(Grant NsG-5080)
(E76-10439; NASA-CR-148516) Avail: NTIS HC $4.00 CSCL 02C

There are no author-identified significant results in this report.

N76-29670*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES

Progress Report, May - Jul. 1976
V. Klemas, Principal Investigator, D. S. Bartlett, W. Philpot, and G. R. Davis 30 Jul. 1976 10 p refs ERTS
(Contract NAS5-20983)
(E76-10440; NASA-CR-148517) Avail: NTIS HC $3.50 CSCL 05A

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 proved valuable in determining the location, type, and extent of estuarine fronts under different tidal conditions. Neither ships nor aircraft alone could provide as complete, synoptic, and repetitive an overview as did the satellites.

N76-29671*# Delaware Univ., Newark. Coll. of Marine Studies.
ESTUARINE DENSITY FRONTS AND THEIR EFFECT ON OIL SLICKS
V. Klemas, Principal Investigator, D. Polis, and G. R. Davis 23 Jul. 1976 2 p ERTS
(Contract NAS5-20983)
(E76-10441; NASA-CR-148518) Avail: NTIS HC $3.50 CSCL 13B

The author has identified the following significant results. Estuarine fronts represent regions of extremely high gradient or discontinuity in various parameters of physical interest, the most important being the water velocity and density fields. Aircraft and boats were combined to study the behavior of different types of fronts in Delaware Bay and their effect on pollutants in order to provide a basis for improving an oil drift and spreading model. Imagery from the LANDSAT satellites provided the most effective means of determining the location and extent of frontal systems over all portions of the tidal cycle. This data is being used to modify the oil drift and spreading model.

N76-29672*# Delaware Univ., Newark. Coll. of Marine Studies.
REMOTE SENSING OF COASTAL POLLUTANTS
V. Klemas, Principal Investigator, G. R. Davis, W. Whelan (ITT Electro-Physics Labs.), and G. Tornatore (ITT Electro-Physics Labs.) 24 Jul. 1976 2 p ERTS
(Contract NAS5-20983)
(E76-10442; NASA-CR-148519) Avail: NTIS HC $3.50 CSCL 13B

There are no author-identified significant results in this report.

N76-29673*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT Progress Report, 1 May - 31 Jul. 1976
M. Griggs, Principal Investigator 31 Jul. 1976 11 p ERTS
(Contract NAS5-20899)
(E76-10443; NASA-CR-148520; SAI-76-691-LJ; PR-6) Avail: NTIS HC $3.50 CSCL 04A

There are no author-identified significant results in this report.

N76-29674*# Delaware Univ., Newark. Center for Remote Sensing.
LOW-COST, AERIAL PHOTOGRAPHIC INVENTORY OF TIDAL WETLANDS Final Report
V. Klemas, Principal Investigator, D. S. Bartlett, O. W. Crichton, and G. R. Davis Jul. 1976 30 p refs ERTS
(E76-10444; NASA-CR-148521; CRS-2-76) Avail: NTIS HC $4.00 CSCL 14E

There are no author-identified significant results in this report.

N76-29675*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Mar. - 19 Jun. 1976
Ira S. Latimer, Jr., Principal Investigator 19 Jun. 1976 18 p refs ERTS
(E76-10445; NASA-CR-148522; PR-3) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-29676*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO Interim Report, Mar. - May 1976
D. H. Knepper, Principal Investigator Jun. 1976 11 p ERTS
(Contract NAS5-20914)
(E76-10446; NASA-CR-148523; QPR-4) Avail: NTIS HC $3.50 CSCL 08L

There are no author-identified significant results in this report.

N76-29677*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Quarterly Progress Report, 13 Apr. - 13 Jul. 1976
Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, Arthur J. Richardson, James H. Everitt, and Alvin H. Gerbermann, Principal Investigators Jul. 1976 17 p refs ERTS
(NASA Order S-53876-AG)
(E76-10447; NASA-CR-148524; QPR-6) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. Field spectral measurements and laboratory densitometric measurements showed that tree canopy reflectance differences among the Marrs, Redblush, and Valencia varieties in the visible spectral region were due to their different leaf chlorophyll concentrations. Field measurements of visible light reflectance were directly related to the tonal responses on infrared color photos of the varietal tree canopies. Consequently, densitometric measurements of the foliage on the infrared color transparency with red-filtered light successfully discriminated among the three varieties. Reflectance measurements with a field spectroradiometer on nine dates the growing season of two wheat varieties, Milam and Penjamo, documented their spectra over the 0.45 to 2.50 micron wavelength interval associated with plant cover and physiological development. An image analyzer system was used to optically planimeter the percentage of soil background, vegetation and shadow in the vertical photographs taken within the FOV of the spectroradiometer on each measurement date.

N76-29678*# Delaware Univ., Newark. Coll. of Marine Studies.
REMOTE SENSING OF COASTAL WETLAND VEGETATION AND ESTUARINE WATER PROPERTIES
Vytautas Klemas, Principal Investigator 1975 38 p refs Presented at 3d Intern. Estuarine Res. Conf., Galveston, Tex., 6-9 Oct. 1975 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10448; NASA-CR-148525) Avail: NTIS HC $4.00 CSCL 08A

There are no author-identified significant results in this report.

N76-29679*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Mar. - 7 Jun. 1976
Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 21 Jun. 1976 4 p ERTS
(NASA Order S-54053-A)
(E76-10450; NASA-CR-148527; PR-5) Avail: NTIS HC $3.50 CSCL 02F

There are no author-identified significant results in this report.

N76-29680*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
URBAN LAND USE MONITORING FROM COMPUTER-IMPLEMENTED PROCESSING OF AIRBORNE MULTISPECTRAL DATA
W. J. Todd, (EROS Data Center), P. W. Mausel, (Indiana St. Univ.), and M. F. Baumgardner 1976 7 p refs

(Contract NAS9-14016)
(NASA-CR-147789; LARS-I-N-032576) Avail: NTIS HC $3.50 CSCL 08B

Machine processing techniques were applied to multispectral data obtained from airborne scanners at an elevation of 600 meters over central Indianapolis in August, 1972. Computer analysis of these spectral data indicate that roads (two types), roof tops (three types), dense grass (two types), sparse grass (two types), trees, bare soil, and water (two types) can be accurately identified. Using computers, it is possible to determine land uses from analysis of type, size, shape, and spatial associations of earth surface images identified from multispectral data. Land use data developed through machine processing techniques can be programmed to monitor land use changes, simulate land use conditions, and provide impact statistics that are required to analyze stresses placed on spatial systems.
Author

N76-29681# Committee on Government Operations (U. S. Senate).
PROCUREMENT OF PETROLEUM PRODUCTS BY THE MILITARY
Washington GPO 1975 49 p refs Staff study for Permanent Subcomm. on Investigations of Comm. on Govt. Operations, 94th Congr., 1st Sess., Apr. 1975
(GPO-50-191) Avail: SOD HC $0.70

The purchase of refined petroleum products required to service the United States military forces was investigated. Competitive bids, negotiated contracts, the allocation program, and the Federal Energy Administration Regulations are discussed. The oil procurement practices of the contracting officers are evaluated with special emphasis on Jp-4 and Jp-5 fuels. F.O.S.

N76-29682# Committee on Aeronautical and Space Sciences (U. S. Senate).
AN ANALYSIS OF THE FUTURE LANDSAT EFFORT
Washington GPO 1976 45 p Staff rept. for Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 10 Aug. 1976
(GPO-75-422) Avail: SOD HC $0.70

The Senate report concerning the operational configuration of a LANDSAT system is presented. Background material including descriptions of uses are given along with characteristics of a LANDSAT operational system. Programmatic and institutional issues are discussed, and recommendations are included. F.O.S.

N76-29683*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION Quarterly Report, 23 Oct. 1975 - 23 Jan. 1976
29 Feb. 1976 188 p refs
(Contract NAS5-21808)
(NASA-CR-144772; DOC-76SDS4207) Avail: NTIS HC $7.50 CSCL 05B

Flight performances of LANDSAT 1 and LANDSAT 2 are evaluated. The in-flight systems discussed are: (1) power supplies, (2) attitude control, (3) command/clock, (4) telemetry, (5) orbit adjust, (6) electrical interface, (7) thermal, (8) tape recorders, (9) multispectral scanner, (10) data collection and (11) magnetic moment compensating assembly. Tables are presented for easy reference. L.S.

N76-29684*# General Electric Co., Philadelphia, Pa. Space Division.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JULY 1975 TO 23 OCTOBER 1975
1 Dec. 1975 195 p
(Contract NAS5-21808)
(NASA-CR-144771; DOC-76SDS4266) Avail: NTIS HC $7.50 CSCL 05B

The orbital operations and payload subsystems performance of LANDSAT 1 and LANDSAT 2 are described. Various operational problems and their solutions are discussed. D.M.L.

N76-29685*# Geological Survey, Reston, Va.
COMBINED MAGNETIC AND GRAVITY ANALYSIS Final Report
W. J. Hinze (Purdue Univ.), L. W. Braile (Purdue Univ.), V. W. Chandler (Purdue Univ.), and F. E. Mazella (Purdue Univ.) Jun. 1975 89 p refs
(NASA Order S-50029A)
(NASA-CR-144767) Avail: NTIS HC $5.00 CSCL 08N

Efforts are made to identify methods of decreasing magnetic interpretation ambiguity by combined gravity and magnetic analysis, to evaluate these techniques in a preliminary manner, to consider the geologic and geophysical implications of correlation, and to recommend a course of action to evaluate methods of correlating gravity and magnetic anomalies. The major thrust of the study was a search and review of the literature. The literature of geophysics, geology, geography, and statistics was searched for articles dealing with spatial correlation of independent variables. An annotated bibliography referencing the Germane articles and books is presented. The methods of combined gravity and magnetic analysis techniques are identified and reviewed. A more comprehensive evaluation of two types of techniques is presented. Internal correspondence of anomaly amplitudes is examined and a combined analysis is done utilizing Poisson's theorem. The geologic and geophysical implications of gravity and magnetic correlation based on both theoretical and empirical relationships are discussed. Author

N76-29686*# General Electric Co., Philadelphia, Pa. Space Div.
TERSSE. DEFINITION OF THE TOTAL EARTH RESOURCES SYSTEM FOR THE SHUTTLE ERA. VOLUME 9: EARTH RESOURCES SHUTTLE APPLICATIONS
U. Alverado Aug. 1975 170 p refs
(Contract NAS9-13401)
(NASA-CR-147840) Avail: NTIS HC $6.75 CSCL 08B

The use of the space shuttle for the Earth Resources Program is discussed. Several problems with respect to payload selection, integration, and mission planning were studied. Each of four shuttle roles in the sortie mode were examined and projected into an integrated shuttle program. Several representative Earth Resources missions were designed which would use the shuttle sortie as a platform and collectively include the four shuttle roles. An integrated flight program based on these missions was then developed for the first two years of shuttle flights. A set of broad implications concerning the uses of the shuttle for Earth Resources studies resulted. D.M.L.

N76-29687*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
TERSSE. DEFINITION OF THE TOTAL EARTH RESOURCES SYSTEM FOR THE SHUTTLE ERA. VOLUME 10: (TOSS) TERSSE OPERATIONAL SYSTEM STUDY
W. Kent Stow, Charles Cheeseman, William Dallam, David Dietrich, Gerald Dorfman, Robert Fleming, Ronald Fries, Wayne Guard, Fredrick Jackson, Herman Jankowski et al Dec. 1975 626 p refs Prepared in cooperation with ECON, Inc., Princeton, N. J. 10 Vol.
(Contract NAS9-13401)
(NASA-CR-147841) Avail: NTIS HC $16.25 CSCL 14E

Economic benefits studies regarding the application of remote sensing to resource management and the Total Earth Resources for the Shuttle Era (TERSSE) study to outline the structure and development of future systems are used, along with experience from LANDSAT and LACIE, to define the system performance and economics of an operational Earth Resources system. The system is to be based on current (LANDSAT follow-on) technology and its application to high priority resource management missions, such as global crop inventory. The TERSSE Operational System Study (TOSS) investigated system-level design alternatives using economic performance as the evaluation criterion. As such, the TOSS effort represented a significant step forward in the systems engineering and economic analysis of Earth Resources programs. By parametrically relating engineering design parameters, such as sensor performance details, to the economic benefit mechanisms a new level of confidence in the conclusions concerning the implementation of such systems can be reached. Author

N76-29688*# Transemantics, Inc., Washington, D.C.
USE OF SATELLITES FOR THE STUDY OF TROPICAL VEGETATION
M. Soto, A. Gomez Pompa, F. Menendez, and G. Arp Washington NASA Aug. 1976 13 p refs Transl. into ENGLISH from

Ciencia y Desarrollo (Mexico), v. 2, no. 7, Mar - Apr. 1976 p 3-6
(Contract NASw-2792)
(NASA-TT-F-17169) Avail: NTIS HC $3.50 CSCL 08F

The results obtained in the first attempt to use remote satellite sensing to assist in the preparation of maps of the vegetation of Veracruz are presented. Tropical vegetation is difficult to study because of its diversity, constant change and lack of ground studies. The research obtained from remote satellite sensing contributes to the solution of this type of problem in tropical studies. Author

N76-29689*# Kanner (Leo) Associates, Redwood City, Calif.
REMOTE PERCEPTION PROJECT. REPORT ON ACTIVITIES AND ACHIEVEMENTS: STAGE ZERO
Adolfo Guzman Washington NASA Aug. 1976 80 p refs Transl. into ENGLISH of "Proyecto Pr. Informe de Actividades y Logros Etapa Cero", Rept. PR-75-2A Centro de Invest. en Math. Apl. y en Sistemas, Mexico, 1975 p 1-85
(Contract NASw-2790)
(NASA-TT-F-17168; PR-75-2A) Avail: NTIS HC $5.00 CSCL 05B

The purpose of the Remote Perception Project is the study and development of computer techniques and procedures for analysis of multispectral images from flight platforms (artificial satellites and aircraft). The purpose is to determine automatically, different items in the area photographed, such as crops, pastures, bodies of water, estuaries, urban areas, etc., and the changes occurring in time. The foundation of the Remote Perception Project, whose nature is multidisciplinary, is the computer sciences, especially in the recognition of shapes, numerical analysis, and the digital processing of images. Author

N76-29690*# Scientific Translation Service, Santa Barbara, Calif.
REMOTE SENSING BY COMPUTER: EQUIPMENT, PROGRAMS, AND APPLICATIONS
Adolfo Guzman Washington NASA 13 Aug. 1976 53 p refs Transl. into ENGLISH from Technical Report (Mexico), v. 3, p 1-62
(Contract NASw-2791)
(NASA-TT-F-17167) Avail: NTIS HC $4.50 CSCL 05B

The computer programs and associated equipment necessary or suitable for carrying out work on classification, identification of crops, mapping soil utilization, and in general remote sensing activities which may be carried out with the help of a digital computer are described. The hierarchy of resources necessary for developing related complementary activities, such as printing negatives, altered photographs, digitalization of photographic negatives, etc., which a computer carries out in the support of remote sensing activities and pattern recognition, is also mentioned. Applications in Mexico and abroad are mentioned. Author

N76-29691# Coastal Engineering Research Center, Fort Belvoir, Va.
AN ERTS-1 STUDY OF COASTAL FEATURES ON THE NORTH CAROLINA COAST
George H. Miller and Dennis W. Berg Jan. 1976 43 p refs
(AD-A022336; CERC-MR-76-2) Avail: NTIS CSCL 08/6

Unenhanced imagery recorded by the multispectral scanner (MSS) of the NASA Earth Resources Technology Satellite (ERTS-1) was analyzed to determine how satellite imagery may be applied to specific coastal engineering problems. The study area is a segment of the North Carolina coast comprising Wrightsville Beach, Masonboro Inlet, Masonboro Beach, Carolina Beach Inlet, and Carolina Beach, which are areas of ongoing research by CERC. Analysis was supplemented by underflight imagery supplied by NASA and ground-truth data. Several significant coastal features are visible in the ERTS-1 imagery. Among those are plumes of suspended sediment emerging from inlets, changes in water coloration possibly due to effects of temperature change, inlet bars, and cape bars. In addition, morphological changes in selected coastal land features were determined by comparing ERTS-1 films obtained about 1 year apart. GRA

N76-29692# Minnesota Water Resources Council, St. Paul. Water and Related Land Resources Information Systems Subcommittee.
WATER INFORMATION SYSTEMS CATALOG
Mar. 1975 149 p
(PB-251688/8; MWRC-1; W76-06256;
OWRT-A-031-MINN(1)) Avail: NTIS HC $6.00 CSCL 13B

The catalog is a compilation of inventories of water and related land resources information systems used by state agencies, selected colleges, and the University of Minnesota. This catalog is divided into four sections. The first offers an introduction, study outline and rationale for the catalog. The second describes the many information systems inventoried. A third section of this catalog is a cross tabulation of information types and organizations. This shows which organizations manage which information types. Thus, organization, information types, methodology of collection, use, and analysis are presented in cross-tabulation. The final section of the catalog is a detailed index of information types which indicates the pages from the catalog on which this information is discussed. GRA

N76-29693# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
USE OF RADAR IMAGES IN TERRAIN ANALYSIS: AN ANNOTATED BIBLIOGRAPHY
L. F. Dellwig, B. C. Hanson, N. E. Hardy, P. L. Hulen, and J. R. McCauley Sep. 1975 338 p
(Contract DAAK02-75-C-0145)
(AD-A020598; RSL-TR-288-2; ETL-0024) Avail: NTIS CSCL 08/6

An annotated bibliography of articles, papers and reports dealing with the application of imaging radar systems to the geosciences has been prepared to meet the needs of both the potential user of radar imagery and the researcher in the field of tactical terrain analysis. The principles of imaging radars are described in an introductory section. Following are bibliographic entries which have been prepared for those pertinent publications produced since the earliest days of imaging radars up to the present time (May, 1975). GRA

N76-29694# Defense Mapping Agency, Washington, D.C.
GEODETIC SURVEY COORDINATES TO SUPPORT GLOBAL POSITIONING SYSTEM TESTS AT YUMA PROVING GROUNDS ARIZONA Final Report
Oct. 1975 173 p refs
(AD-A021478; DMA/TR-76-002) Avail: NTIS CSCL 08/5

Geodetic and GEOCEIVER surveys were performed by Defense Mapping Agency personnel at Yuma Proving Grounds Arizona to support positioning requirements for Global Positioning System tests and evaluation. Geodetic field surveys began in November 1974 and ended in February 1975. GEOCEIVER surveys were conducted in March and April of 1975. Upon completion of these surveys, computations were made to determine Adjusted NAD 27 and WGS 72 geodetic coordinates for selected survey sites. Yuma local rectangular as well as Universal Transverse Mercator grid coordinates are also provided. GRA

N76-29695# Army War Coll., Carlisle Barracks, Pa.
ALASKA'S NORTH SLOPE OIL FIELDS: ENERGY ASSET OR DEFENSE LIABILITY
Lewis L. Simpson 2 Oct. 1975 34 p refs
(AD-A022366) Avail: NTIS CSCL 21/4

Discovery of an oil bonanza under Alaska's North Slope offers the hope of some relief from dependence on foreign oil sources. At the same time, the vulnerability to hostile action of the oil fields, of the pipeline carrying crude oil to Valdez, and of the tankers shipping oil from Valdez to refineries suggests that reliance on oil from northern Alaska may be an Achilles heel strategically in time of war. The dilemma caused by the juxtaposition of these two factors was examined in this essay. Research was conducted through a review of the current literature. Present estimates of oil reserves under the North Slope lend credence to the belief that Alaskan oil can provide a measure of self-sufficiency in oil reserves to the US. As such, these fields are of major strategic import. Difficulties include the isolation, terrain, and weather features associated with the area and the complexities in transporting supplies and materials to the North Slope and in getting crude oil from the wellheads to refineries. These problems also affect the capability of the US to safeguard the various installations in case of war, but the vital strategic

significance of this oil mandates the utmost vigilance in its protection from all sources of attack. Author (GRA)

N76-29696*# Aerospace Corp., El Segundo, Calif. Lab. Operation.
THE 90 GHz RADIOMETRIC IMAGING Final Report
H. E. King, J. D. White, W. J. Wilson, T. T. Mori, J. P. Hollinger (NRL, Washington, D. C.), B. E. Troy (NRL, Washington, D. C.), J. E. Kenney (NRL, Washington, D. C.), and J. T. McGoogan (NASA, Wallops Station) 19 Feb. 1976 55 p refs Sponsored in part by NASA
(Contract F04701-75-C-0076)
(NASA-CR-148581; AD-A022241; SAMSO-TR-76-37) Avail: NTIS CSCL 14/2

A 90-GHz (3 mm wavelength) radiometer with a noise output fluctuation of 0.22 K (RMS), with a scanning antenna beam mirror, and the data processing system are described. Real-time radiometric imaging of terrain and man-made objects are shown. Flying at an altitude of 1500 ft a radiometer antenna with a 2 degrees halfpower beamwidth can distinguish landforms, waterways, roads, runways, bridges, ships at sea and their wakes, aircraft on runways, and athletic fields. A flight taken at an altitude of 3000 ft with approximately 2000 ft of clouds below the radiometer demonstrates the ability to distinguish bridges, rivers, marshland and other landforms even though the clouds are optically opaque. The radiometric images of a few representative scenes along with photographs of the corresponding scenes are presented to demonstrate the resolution of the imager system. GRA

N76-29697# Rutgers Univ., New Brunswick, N.J. Water Resources Research Inst.
REORIENTATION OF URBAN WATER RESOURCES RESEARCH Final Report
William Whipple, Jr., Maynard M. Hufschmidt (North Carolina Univ., Chapel Hill), Bernard B. Berger (Univ. of Mass.), David H. Howells (North Carolina Univ., Chapel Hill), L. Douglas James (Ga. Inst. of Tech.), and L. Scott Tucker (Urban Drainage and Flood Control District, Denver) Apr. 1976 58 p Workshop held at Quail Roost, N. C., 24-26 Jul. 1975
(Contract DI-14-31-0001-5134)
(PB-251907/2; W76-06553; OWRT-B-062-NJ(1)) Avail: NTIS HC $4.50 CSCL 13B

The consensus was that the Federal approach to water resources has generally neglected the problems of metropolitan areas. Hydrological, water quality and ecological data are insufficient. Technology to meet many problems is lacking, and existing institutions are ill adapted to the problems now being encountered. Particular emphasis in urban-related research needs to be given to fields of water quality, flood plain management, and interfaces with land-use planning and control. Strategies and basic objectives should be reexamined as well as the problems of planning to meet environmental objectives at reasonable cost. Programs of urban-related water resources research are recommended. Author (GRA)

N76-29698# Rutgers Univ., New Brunswick, N.J.
REORIENTATION OF URBAN WATER RESOURCES RESEARCH
William Whipple, Jr., Maynard M. Hufschmidt (N. Carolina Univ., Chapel Hill), Bernard B. Berger (Mass. Univ.), David H. Howells (N. Carolina Univ., Chapel Hill), L. Douglas James (Ga. Inst. of Tech.), and L. Scott Tucker (Urban Drainage and Flood Control District, Denver) Apr. 1976 19 p Workshop held at Quail Roost, N. C., 24-26 Jul. 1975
(Contract DI-14-31-0001-5134)
(PB-251908/0; W76-06554; OWRT-B-062-NJ(1)) Avail: NTIS HC $3.50 CSCL 13B

Recommendations for urban-related research related to water quality propose development of strategy and methodology to contribute to remedying the various deficiencies, including those in the basic planning goals and approaches, better methods of measuring and evaluating pollution from urban runoff, methods of determining the environmental effects of pollution, alternative water quality enhancement approaches (other than effluent treatment), and a better institutional framework for areawide planning. There is no unified national policy for flood plain management. Goals of economic efficiency, of avoidance of social disruption, of financial aid after a disaster, and of better land use of flood plains are expressed implicitly in various Federal programs. Much state legislation needs modernization to keep pace with new developments. Author (GRA)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-29699* National Aeronautics and Space Administration, Washington, D.C.
RECHARGEABLE BATTERY WHICH COMBATS SHAPE CHANGE OF THE ZINC ANODE Patent
Ernest M. Cohn, inventor (to NASA) Issued 3 Aug. 1976 4 p Filed 13 Aug. 1975 Supersedes N75-32583 (13 - 23, p 2938)
(NASA-Case-HQN-10862-1; US-Patent-3,972,727; US-Patent-Appl-SN-604374; US-Patent-Class-136-30; US-Patent-Class-136-143) Avail: US Patent Office CSCL 10C

A rechargeable cell or battery is provided in which shape change of the zinc anode is combatted by profiling the ionic conductivity of the paths between the electrodes. The ion flow is greatest at the edges of the electrodes and least at the centers, thereby reducing migration of the zinc ions from edges to the center of the anode. A number of embodiments are disclosed in which the strength and/or amount of electrolyte, and/or the number and/or size of the paths provided by the separator between the electrodes, are varied to provide the desired ionic conductivity profile. Official Gazette of the U.S. Patent Office

N76-29700* National Aeronautics and Space Administration. Pasadena Office, Calif.
HYDROGEN RICH GAS GENERATOR Patent
John Houseman (JPL), Jack H. Rupe (JPL), and Raymond O. Kushida, inventors (to NASA) (JPL) Issued 11 May 1976 11 p Filed 10 Feb. 1975 Continuation-in-part of abandoned US Patent Appl. SN-390049, filed 20 Aug. 1973 Sponsored by NASA
(NASA-Case-NPO-13342-2; US-Patent-3,955,941; US-Patent-Appl-SN-548559; US-Patent-Class-48-95; US-Patent-Class-23-281; US-Patent-Class-48-215; US-Patent-Class-123-1A; US-Patent-Class-123-3; US-Patent-Class-423-650; US-Patent-Appl-SN-390049) Avail: US Patent Office CSCL 10A

A process and apparatus is described for producing a hydrogen rich gas by injecting air and hydrocarbon fuel at one end of a cylindrically shaped chamber to form a mixture and igniting the mixture to provide hot combustion gases by partial oxidation of the hydrocarbon fuel. The combustion gases move away from the ignition region to another region where water is injected to be turned into steam by the hot combustion gases. The steam which is formed mixes with the hot gases to yield a uniform hot gas whereby a steam reforming reaction with the hydrocarbon fuel takes place to produce a hydrogen rich gas.
Official Gazette of the U.S. Patent Office

N76-29701* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR-POWERED PUMP Patent
Charles C. Kirsten, inventor (to NASA) (JPL) Issued 3 Aug. 1976 6 p Filed 9 Apr. 1975 Supersedes N75-22746 (13 - 14, p 1659) Sponsored by NASA
(NASA-Case-NPO-13567-1; US-Patent-3,972,651; US-Patent-Appl-SN-566493; US-Patent-Class-417-141; US-Patent-Class-60-517; US-Patent-Class-62-6; US-Patent-Class-417-207; US-Patent-Class-417-379;

US-Patent-Class-417-209) Avail: US Patent Office CSCL 10A

A solar powered pump particularly suited for intermittently delivering a stream of water is reported. The pump is characterized by a housing adapted to be seated in a source of water having a water discharge port disposed above the water line of the source, a sump including a valved inlet port through which water is introduced to the sump, disposed beneath the water line, a displacer supported for vertical reciprocation in said housing, an air passageway extended between the vertically spaced faces of the displacer, and a tipple disposed adjacent to the water discharge port adapted to be filled in response to a discharge of water from the housing. Air above a displacer is expanded in response to solar energy impinging on the housing and transferred into pressurizing relation with the sump for forcing water from the sump. Official Gazette of the U.S. Patent Office

N76-29702*+ National Aeronautics and Space Administration, Washington, D.C.

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 8, FEBRUARY 1976

Feb. 1976 280 p refs

(NASA-SP-7043(08)) Avail: NTIS HC $4.00 CSCL 10B

This bibliography lists 397 reports, articles, and other documents introduced into the NASA scientific and technical information system from October 1, 1975 through December 31, 1975. Author

N76-29703*+ National Aeronautics and Space Administration, Washington, D.C.

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 9, APRIL 1976

Apr. 1976 102 p refs

(NASA-SP-7043(09)) Avail: NTIS HC $4.00 CSCL 10B

This bibliography lists 345 reports, articles, and other documents introduced into the NASA scientific and technical information system from January 1, 1976 through March 31, 1976. Author

N76-29704* National Aeronautics and Space Administration. Pasadena Office, Calif.

HYDROGEN RICH GAS GENERATOR Patent

John Houseman, inventor (to NASA) (JPL) Issued 27 Jul. 1976 10 p Filed 27 Feb. 1975 Supersedes N76-16241 (14 - 07, p 0826) Division of US Patent Appl. SN-428444, filed 26 Dec. 1973, US Patent-3,920,416 Sponsored by NASA

(NASA-Case-NPO-13464-2; US-Patent-3,971,847; US-Patent-Appl-SN-553687; US-Patent-Class-423-650; US-Patent-Class-48-197R; US-Patent-Class-42-215; US-Patent-Class-252-373; US-Patent-Class-431-4; US-Patent-Class-431-163; US-Patent-Class-431-210; US-Patent-Appl-SN-428444; US-Patent-3,920,416) Avail: US Patent Office CSCL 10A

A process and apparatus is described for producing a hydrogen rich gas by introducing a liquid hydrocarbon fuel in the form of a spray into a partial oxidation region and mixing with a mixture of steam and air that is preheated by indirect heat exchange with the formed hydrogen rich gas, igniting the hydrocarbon fuel spray mixed with the preheated mixture of steam and air within the partial oxidation region to form a hydrogen rich gas. Official Gazette of the U.S. Patent Office

N76-29705*# Scientific Translation Service, Santa Barbara, Calif.

SIMULATION OF SILICON SOLAR CELLS AND COMPARISON WITH EXPERIMENTAL RESULTS

J. Michel and A. Mircea Washington NASA Aug. 1976 42 p refs Transl. into ENGLISH from Acta Electronica (France), v. 18, no. 4, Oct. 1975 p 311-320

(Contract NASw-2791)

(NASA-TT-F-17137) Avail: NTIS HC $4.00 CSCL 10A

A detailed description of the physical-mathematical model developed for computer simulation of the operation of photovoltaic cells is given. This program is particularly flexible and implies little working cost. Its use in analyzing the effect of numerous parameters on the conversion output of silicon cells with an n-p and n-p-p structure is described. It is shown that it is possible to achieve better conversion outputs with thin cells (50 to 100 micrometers) than with cells of the usual thickness (300 micrometers). Author

N76-29706# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.

HYDROGEN PRODUCTION, STORAGE, AND CONVERSION FOR ELECTRIC UTILITY AND TRANSPORTATION APPLICATION

S. Srinivasan and R. H. Wiswall Oct. 1975 28 p refs Sponsored by ERDA

(BNL-20590) Avail: NTIS HC $4.00

The energy efficiency for hydrogen production by water electrolysis is about 75%. With improved catalysts, higher operating temperatures and better separator materials in advanced systems (Teledyne, Lurgi, and General Electric water electrolyzers), it should be possible to carry out water electrolysis at close to 100% efficiencies. The storage of hydrogen as a metal hydride shows significant advantages over the cryogenic or compressed gas procedures. For electric utility applicatons, its feasibility is demonstrated using an iron-titanium alloy. Though this alloy may also be suitable for hydrogen storage in buses and trains, it will be necessary to consider the lighter hydrides for automobiles. With fuel cells or combined cycle gas turbines, it should be possible to attain energy conversion efficiencies of about 60%. The present status and potential for improvements in acid, alkaline, molten carbonate, and solid oxide fuel cell systems are briefly summarized. Author (ERA)

N76-29707# McElroy (Ralph) Co., Austin, Tex.

METHANOL AS A FUEL

T. Yamamoto [1973] 16 p Transl. into ENGLISH from Sekiyu Gakkaishi (Japan), v. 16, no. 10, 1973 p 825-828 Sponsored by ERDA

(UCRL-Trans-10697) Avail: NTIS HC $3.50

The significant difference between methanol fuel and hydrocarbon fuel is that the latter has a heating value of 10,000 cal and the former has 5,000 cal, one half of the latter, and the latter has 50-100 cal of latent heat of vaporization and the former has a great latent heat of vaporization of 263 cal. Moreover, methanol is soluble in water and sensitive to various kinds of chemical reaction. These properties are drawbacks as a fuel. However, they are changed into advantages by suitable application and treatment. The following uses for methanol are discussed: (1) source material for hydrogen; (2) fuel for small scale electricity generation by fuel cells; (3) fuel for a boiler which does not produce NO/sub x/; (4) fuel for a non-polluting car; (5) resources for city gas; (6) use for the production of deoxidizing gas in metallurgy; and (7) use for the synthesis of protein from methanol feeding microbes. These usages make use of the special properties of methanol and can display the true value of methanol as a fuel. Author (ERA)

N76-29708# Dow Chemical Co., Midland, Mich.

SOLAR ENERGY SUBSYSTEMS EMPLOYING ISOTHERMAL HEAT STORAGE MATERIALS, PHASE 1 Technical Report, 18 Sep. 1974 - 30 Apr. 1975

G. A. Lane, D. N. Glew, E. C. Clarke, S. W. Quigley, and H. E. Rossow May 1975 43 p refs Sponsored by ERDA

(Contract NSF C-906)

(ERDA-117) Avail: NTIS HC $4.00

The literature was searched for phase-change solar heat storage candidate materials melting in the range 10 to 90 C. About 200 salts, organic compounds, and eutectic substances were selected initially. These are tabulated in this report. Through the use of DTA and freezing curve data, this group was reduced to approximately 50 candidates, about 20 of which exhibit little or no supercooling. The latter are prime candidates for encapsulation studies. Heat of fusion measurements have been made on most of these 20 materials. Thermal cycling studies have begun, and other tests are under way. Author (ERA)

N76-29709# Mobil Tyco Solar Energy Corp., Waltham, Mass.

PHOTOVOLTAIC ENGINEERING SERVICES PERTINENT TO SOLAR ENERGY CONVERSION

R. O. Bell, J. C. T. Ho, W. Kurth, and T. Surek Jun. 1975 127 p refs

(Contract W-31-109-eng-38)

(ANL-K-75-3171-1) Avail: NTIS HC $7.00

The application of the compound parabolic concentrator (CPC) for use with solar cells was investigated. Experiments with state-of-the-art Si cells in a CPC and under solar concentration were performed. A theoretical model for calculating the behavior of Si solar cells with concentration was developed. Detailed calculations of the energy distribution in the CPC were made. Finally a cost effectiveness analysis shows that the CPC system will produce power at very much lower cost than will flat panel solar cell arrays. Author

N76-29710# Naval Weapons Center, China Lake, Calif. Research Dept.
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES
D. A. Fine and Aaron N. Fletcher Feb. 1976 25 p refs
(AD-A021424; NWC-TP-5813) Avail: NTIS CSCL 10/3

This report summarizes preliminary investigations on photoelectrical systems involving thionine dye and inorganic reducing agents; these systems offer potential for use as photogalvanic cells in solar energy conversion. The report stresses the thionine-cobalt (II) ethylene-diaminetetraacetate (EDTA) system, which has yielded voltages and currents comparable to and in some cases exceeding those which have been reported for the thionine-Fe(2+) system. Measurements on the thionine-CoEDTA(2-) system have been carried out using two types of transparent electrode, tin dioxide and gold/palladium. Effects of concentration and aging on voltages are reported here, as well as results of closed-circuit measurements under load. GRA

N76-29711# National Swedish Inst. for Building Research, Stockholm.
HEAT PUMP APPLICATIONS IN SWEDEN: RESEARCH AND DEVELOPMENT NEEDS Building Research
Zahr Fikri 1975 196 p refs
(PB-251356/2; ISBN-91-540-2487-0; D8-1975) Avail: NTIS HC $7.50 CSCL 13A

The report presents the results from the first phase of investigations into the research and development needs in heat pump system applications in Sweden. A detailed R and D program covering a 10 years period has been prepared. A cost estimate for two alternatives, namely 10 and 20 million Swedish Crowns, is presented. Topics discussed in this report include the following: (1) energy management and heat pumps; (2) different aspects of heat pump applications in Sweden, (3) heat pump performance and reliability; (4) heat pump systems; (5) building design aspects; (6) heat pumps and the energy systems; (7) heat pump control systems; (8) system simulation and evaluation techniques; (9) current research and development in heat pump applications; and (10) research and development program. GRA

N76-29712# Infodyne Systems, Inc., Potomac, Md.
ECONOMIC IMPACT STUDY OF THE APPLIANCE EFFICIENCY PROGRAM Final Report
Alexander Woroniak and John J. Murphy Jun. 1975 282 p refs
(Contract FEA-CO-04-50234-00)
(PB-251665/6; FEA/D-76/077) Avail: NTIS HC $9.25 CSCL 10A

The economic impact is analyzed of technical improvements that would have to be incorporated into major household appliances to make 1980 models provide the same level of performance as 1972 models, but require twenty per cent less energy to operate. The appliances covered by the efficiency program and their specific energy efficiency goal objectives for 1980 are; room air conditioners; electric and gas water heaters; refrigerators and refrigerator/freezers; freezers; electric and gas ranges; electric and gas dryers; washers; dishwashers; and black and white and color televisions. GRA

N76-29713# Electric Power Research Inst., Palo Alto, Calif.
PROCEEDINGS ON FORECASTING METHODOLOGY FOR TIME-OF-DAY AND SEASONAL ELECTRIC UTILITY LOADS
James W. Boyd, ed. Mar. 1976 272 p refs
(PB-251444/6; EPRI-SR-31) Avail: NTIS HC $9.00 CSCL 10A

The report presents information on the state of the art of seasonal and time-of-day forecasting and explores new methodologies for handling long run conditional forecasting problems. Topics discussed included model selection, short term forecasting, model identification in peak power demand forecasting, intermediate term forecasting of system loads using Box-Jenkins time series analysis load forecasting methodologies in the electric utility industry, estimation of the residential demand cycle for electricity, recent developments in forecasting techniques and strategy, time series modeling and forecasting, and industrial and commercial rate structures and econometric estimation of the demand for electricity. GRA

N76-29714# Electric Power Research Inst., Palo Alto, Calif.
A PRELIMINARY FORECAST OF ENERGY CONSUMPTION THROUGH 1985
Larry J. Williams Mar. 1976 69 p refs
(PB-251445/3; EPRI-SR-37) Avail: NTIS HC $4.50 CSCL 10A

An econometric energy demand model for the nation is analyzed and used to produce interval estimates of energy consumption by fuel type for each economic sector. In addition to presenting forecasts, the more important features and major limitations of the model are discussed. GRA

N76-29715# Electric Power Research Inst., Palo Alto, Calif.
NEAR-TERM ENERGY STORAGE TECHNOLOGIES: THE LEAD-ACID BATTERY
Mar. 1976 231 p refs Workshop held at Palo Alto, Calif., 18-19 Nov. 1975 Prepared in cooperation with Argonne Natl. Lab., Ill., and Intern. Lead Zinc Research Organization, Inc., New York
(PB-251490/9; EPRI-SR-33) Avail: NTIS HC $8.00 CSCL 10C

In 1975, ANL/ERDA, ILZRO, and EPRI initiated cost and design studies of state-of-the-art lead-acid batteries for electric utility application to determine the viability of today's lead-acid batteries for load-leveling application. Manufacturers were selected to develop battery designs (based on state-of-the-art technology) capable of meeting the technical requirements for load-leveling. The cost of manufacturing and the ultimate price for these batteries were determined assuming high volume production (1000 MWH/year). This report contains the papers from the workshop held to present and evaluate the results of these efforts, to provide an information base for utility planners in this area and to obtain the outlook and prospects for these batteries in individual utility systems. GRA

N76-29716# Economic Research Service, Washington, D. C.
ENERGY IN US AGRICULTURE: COMPENDIUM OF ENERGY RESEARCH PROJECTS
Jim Rathwell and Gwendolyn Gales Jan. 1976 187 p
(Contract FEA-GC-04-50057-00)
(PB-247642/2; Conserv-Paper-37A; FEA/D-75/629; FEA/D-CP-37A) Avail: NTIS HC $7.50 CSCL 02C

This document, a compendium of energy research in the production sector of U.S. agriculture, presents approximately 1,250 entries of ongoing or recently completed research projects and article abstracts related to fuel requirements and energy conservation practice and technologies. The abstracts presented focus on three general areas: crop production, livestock production, and state and national energy demand data. The practices and technologies which have been included within the scope are those which can be effectively implemented in U.S. agricultural production either immediately or within the next 5 years. GRA

N76-29717# Battelle Columbus Labs., Ohio.
COMPARISON OF FOSSIL AND WOOD FUELS Final Report
E. H. Hall, C. M. Allen, D. A. Ball, J. E. Burch, and H. N. Conkle Mar. 1976 254 p refs
(Contract EPA-68-02-1323)
(PB-251622/7; EPA-600/2-76-056) Avail: NTIS HC $9.00 CSCL 10B

The use of wood as a fuel for a commercial electric power plant in Vermont is compared with use of clean fossil fuels or fossil fuels with suitable pollution control technology. Wood fuel was derived from forest surplus; the tops and branches of trees cut for commercial purposes, cull or noncommercial trees, and

waste from forest products industries. The comparison considered boiler technology, pollutant emissions, control technology, energy balance, environmental/ecological impact, and cost. Author

N76-29718# Babcock and Wilcox Co., Barberton, Ohio. Fossil Power Generation Div.
LOW BTU GAS STUDY Final Report
Jan. 1976 244 p
(PB-251442/0; CEPRI-265-2-FR) Avail: NTIS HC $8.00 CSCL 10B

Four utility boilers of different designs and firing each of five low to medium Btu gasified coal fuels were investigated to determine the performance of each as built boiler when firing each of the fuels and what physical changes could be made to each unit to permit operation at or near rated capacity and steam temperatures. General observations are: (1) units studied can use the higher Btu fuels, and in most cases, with few modifications; (2) as fuel heating values decrease below 300 Btu/SCF, required boiler modifications and resulting conversion expenses increase rapidly; (3) variances between the five fuels and the original boiler design fuels effect the resulting flue gas properties that influence boiler heat transfer and distribution; and (4) any boiler considered for conversion should be studied in detail using the specific analysis of the proposed gasified coal fuel. GRA

N76-29719# Air Force Academy, Colo.
EXPLORATORY ALUMINUM-CHLORINE THERMALLY ACTIVATED BATTERY: SINGLE CELL EXPERIMENTS Final Technical Report, Mar. 1973 - Nov. 1975
G. Dana Brabson and John K. Erbacher Jan. 1976 134 p refs
(AF Proj. 7903)
(AD-A021664; FJSRL-TR-76-0002) Avail: NTIS CSCL 10/3

Single cells which can be considered prototypes of the individual cells in a low temperature pile type thermal battery have been constructed and characterized. Both binary AlCl3 and NaCl as well as ternary AlCl3, NaCl and KCl electrolytes were studied. Eight concentration cells with aluminum electrodes were tested. Twenty-three formation cells with aluminum anodes were studied; cathode configurations tested in formation cells included: (1) Cl2, graphite, W; (2) NiCl2, graphite, Ni, and (3) C4.5F, graphite, W. Materials employed to immobilize the electrolyte included fiberglass felt and Cab-O-Sil. Operating temperatures ranged from 109 C to 222 C. Key findings: (1) NaAlCl4 melts can be effectively immobilized by Cab-O-Sil; (2) Current densities in excess of 1 mA/sq cm can be achieved with formation cells; (3) Both NiCl2, graphite, Ni and C4.5F, graphite, W are attractive candidate cathodes for formation cells. Author (GRA)

N76-29720# Spectrolab, Inc., Sylmar, Calif.
DEVELOPMENT OF NICKEL ALKALINE BATTERIES FOR AEROSPACE LIGHTWEIGHT SECONDARY POWER Final Report, 1 Dec. 1972 - 30 Jun. 1975
Vincent J. Puglisi and Eugene L. Ralph Wright-Patterson AFB, Ohio AFAPL Jun. 1975 170 p refs
(Contracts F33615-73-C-2012; AF Proj. 3145)
(AD-A022350; AFAPL-TR-75-64) Avail: NTIS CSCL 10/3

This program successfully incorporated new improved electrode fabrication procedures into a small scale pilot production facility and produced advanced lightweight aerospace nickel-cadmium cells. The objectives of achieving a minimum energy density of 20 WHr/lb with the 50 AH sealed nickel-cadmium cells was accomplished and two pilot production runs demonstrated that this objective was reached with reproducible results and good yields. The first portion of the program was the investigative phase in which theoretical and analytical studies were performed. The plaque formation process was optimized in respect to sinter porosity and loading level using an electrochemical impregnation technique. In order to develop the optimum cell design, the knowledge obtained from the investigative phase was successfully applied to a mathematical cell design model that was translated into computer language. A computer design of several cells that met the program objectives was then developed. GRA

N76-29721# Department of Transportation, Washington, D.C.
REPORT TO CONGRESS ON ENERGY CONSERVATION POLICIES AND PRACTICES BY THE FEDERAL AVIATION ADMINISTRATION Final Report
Feb. 1976 183 p
(AD-A021312) Avail: NTIS CSCL 21/4

The report is essentially historical in nature and provides a factual presentation of energy policies and practices as required by the Act. These include: Early FAA actions; The FAA's seven-point conservation program and follow-on investigation energy conservation measures; Recent or on-going actions in fuel conservation; and Long-range prospects for energy conservation. GRA

N76-29722# Naval Ship Engineering Center, Hyattsville, Md.
THE FUTURE OF 400 Hz POWER SYSTEMS PRESENT INTERFACE PROBLEMS AND SOLUTIONS
F. R. Henrikson Dec. 1975 26 p Presented at the Ann. Tech. Symp. (13th), Assoc. of Scientists and Engr. of the Naval Air and Sea Systems Commands, Arlington, Va., 12 Mar. 1976
(AD-A022309) Avail: NTIS CSCL 10/2

The long-term solution for the 400 Hz system problems is to eliminate the use of 400 Hz entirely except where 400 Hz is required in the end use. Most 400 Hz power is simply rectified in transformer-rectifier power supplies. New developments in power supply design techniques indicate that 60 Hz power supplies smaller, lighter and more efficient than present 400 Hz power supplies are feasible. Further, the elimination of the 60/400 Hz frequency changers saves weight, volume, and cooling load, and provides a more reliable power source for weapons and electronics. Eliminating the 400 Hz power system is at least ten years away. The mid-term solution is to use frequency changers of the solid-state type. Methods of reducing the harmonic and modulation interference both in the load and on the system are available and are being incorporated in new specifications for load equipment and in the U.S. Navy standard solid-state frequency changers. At the present time, systems are working by virtue of isolating interfering and sensitive loads through the use of large numbers of motor generator sets. GRA

N76-29723# Radian Corp., Austin, Tex.
ELECTRICAL ENERGY AS AN ALTERNATE TO CLEAN FUELS FOR STATIONARY SOURCES, VOLUME 1 Final Report, Jun. 1974 - Oct. 1975
R. M. Wells and W. E. Corbett Mar. 1976 186 p refs 2 Vol.
(Contract EPA-68-02-1319)
(PB-251829/8; EPA-600/2-76-049a-Vol-1) Avail: NTIS HC $7.50 CSCL 10B

The report discusses technical and environmental incentives for increased electrification in stationary use sectors. It compares the impacts that result from the production and consumption of equivalent quantities of natural gas, fuel oil, and electricity. It also examines several alternative methods of producing each end-use fuel and considers technical and economic barriers to increased electrification. Author (GRA)

N76-29724# Environmental Protection Agency, Washington, D.C.
A PRELIMINARY ANALYSIS OF THE ECONOMIC IMPACT ON THE ELECTRIC UTILITY INDUSTRY OF ALTERNATIVE APPROACHES TO SIGNIFICANT DETERIORATION
5 Feb. 1976 59 p refs
(PB-251394/3) Avail: NTIS HC $4.50 CSCL 13B

The principal methodological issue which is addressed relates to the determination of the cost of the Senate and House proposals assuming EPA's current definition of best available control technology. GRA

N76-29725# Air Force Academy, Colo. Frank J. Seiler Research Lab.
HIGH ENERGY DENSITY PELLETIZED ALUMINUM CHLORIDE THERMAL BATTERIES Final Report, Aug. 1974 - Jan. 1976
Charles L. Hussey, John K. Erbacher, and Lowell A. King Jan. 1976 48 p refs
(AF Proj. 7903)
(AD-A021748; FJSRL-TR-76-0003) Avail: NTIS CSCL 10/3

Single cell pelletized thermal batteries using electrolytes of

molten aluminum chloride-sodium chloride mixtures are described. Anodes were made of aluminum, lithium, or aluminum-lithium alloys. A variety of cathodes were employed, including (a) transition metal oxides, halides, and sulfates/graphite or metal powder, (b) halogen/graphite, (c) organic oxidants/graphite, (d) chalcogen/graphite, (e) intercalcate compounds/graphite, (f) alkali salts, peroxydisulfate salts, hypochlorite salts/graphite. Constant load and constant current discharge behaviors are discussed. GRA

N76-29726# Mitre Corp., McLean, Va.
INTERNATIONAL SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT, 5TH
Kuala Lumpur Dec. 1975 477 p Symp. held at Kuala Lumpur, Malaysia, 17-20 Feb. 1975
(PB-251396/8; M75-84) Avail: NTIS HC $12.50 CSCL 10A

A partial listing of topic areas includes: The role of and need for technology in society; Economic development and prospects for mankind; Southeast Asia perspective; The place of energy in world peace; Dimensions of world energy; Nuclear energy infrastructure requirements; Energy scenarios for the future; Livestock and urban waste as future energy resources; Impact of energy resources on agriculture in a developing country; Energy, fertilizer and food; Resource management and international cooperation with special reference to Malaysia; National energy policy as it affects economic development. GRA

N76-29727# National Science Foundation, Washington, D.C. Div. of Advanced Energy Research and Technology.
METHODS OF DIRECT CONVERSION OF THERMAL ENERGY INTO ELECTRICAL ENERGY
Jan. 1975 144 p refs Transl. into ENGLISH from Reports of All-Union Conf. on the Utilization of Solar Energy, Moscow, 17-21 Jun. 1969, section S-6 Sponsored in part by the National Science Foundation
(TT-74-58064) Avail: NTIS HC $6.00 CSCL 10B

Contents: Solar thermionic energy plants; Experimental photobatteries for sea-navigation-light signalling devices; The solar thermoelectric generator as an autonomous source of feed to water elevating installations; Energy balance of solar water elevating installations equipped with photoconverters; Possible energy and technical characteristics of solar thermoelectric generators with two cascade converters; Low temperature thermoelectric converters of solar energy; The photoelectric pump; Investigation of the efficiency of photobatteries at high illumination and temperatures; Investigating the possibilities of augmenting the power of the photoelectric converters of the solar energy; Optimization of the regime of electric energy generation of the autonomous system of the photoelectric generator-direct current motor; The rational utilization of the solar photo-converters plants for sustaining several consumers; The possibilities of using gradiating concentrator for photobatteries; Investigation of radiators for the spreading of heat from the collector-generators of the solar energy. GRA

N76-29728# National Science Foundation, Washington, D.C. Div. of Advanced Energy Research and Technology.
METHODS OF DIRECT CONVERSION OF THERMAL ENERGY INTO ELECTRICAL ENERGY
Jan. 1975 100 p refs Transl. into ENGLISH of Reports of All-Union Conf. on the Utilization of Solar Energy, Moscow, 17-21 Jun. 1969, section S-5.
(TT-74-58067) Avail: NTIS HC $5.00 CSCL 10B

Contents: optical coatings and thermal balance of semiconductor converters used in converting the solar energy into electricity; multilayered illuminating coatings for silicon photoelements; selective coatings for collector surfaces of solar thermoelectric generators; selective properties of the polymer coatings for solar energy concentrators; the effect of temperature on the reflector capacity of aluminum layered concentrators; spectral investigation of ground radiation limits on the SF-4 spectrophotometer; a study of the behavior of new silicon organic polymer materials used in solar energy plants; problems of protection of the working surfaces of solar energy plants in the southern regions of the U.S.S.R.; thermophysical and durability characteristics of solar battery materials; investigation of the absorption capability of metals for solar radiations in the temperature range 400-1500 C; the effect of atmospheric optical mass on the coefficients of selectively coated materials; the selection of construction materials for solar distillation systems; experimental setup for investigating the coefficient of thermal E.M.F. and electric conductivity of semiconductor materials by the dynamic method; some results of accelerated tests on helioplants; and new helioplants for accelerated testing of materials. GRA

N76-29729# Interior Dept., Washington, D.C.
COOLING OF HYDROGENERATORS
T. I. Alper and T. G. Sergievskaya Jan. 1975 484 p refs Transl. into ENGLISH of "OkhlazhdEnie Gidrogeneratorov" Moscow, Energiya Press, 1969 484 p
(Contract NSF 0-466)
(TT-72-51017) Avail: NTIS HC $12.50 CSCL 10B

The physical principles of the operation of cooling systems of hydrogenerators are described covering the following questions: general rational structures of cooling systems of hydrogenerators; methods for experimental investigation of cooling systems; the hydraulic characteristics of pressure elements and stator of a hydrogenerator; arrangements for forced cooling of field coil; cooling of end portions of the stator winding of a hydrogenerator; power losses in a hydrogenerator due to ventilation; heat emission when active members of a hydrogenerator are air-cooled, and general picture of heat transfer in hydrogenerators. Ventilation analysis of a hydrogenerator is given on the basis of physical investigation results and with approximate computation of the overheating of the active member of a hydrogenerator. GRA

N76-29730# Naval Weapons Center, China Lake, Calif.
CONVERSION OF SOLID WASTE TO FUELS Final Report, Jul. 1973 - Jul. 1974
C. B. Benham and J. Diebold Jan. 1976 34 p refs
(ARPA Order 2772)
(AD-A021655; NWC-TR-5797) Avail: NTIS CSCL 13/2

Economic and practical processes for recovering energy from solid waste were studied. Two promising fuels were identified - polymer gasoline and methanol. A nominal 10-pound-per-hour pyrolysis system was constructed and tested. Preliminary cost analyses and studies of the effects of population and energy market value on fuel costs were also conducted. Author (GRA)

N76-29731# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
ALTERNATOR MODELING. PART 1: SIMULATION, PARAMETER ESTIMATION, AND OUTPUT SENSITIVITY ANALYSIS Final Report, Jul. 1974 - Jul. 1975
R. P. Webb, C. W. Brice, A. S. Debs, M. E. Womble, and O. T. Stan Wright-Patterson AFB, Ohio AFAPL Oct. 1975 159 p refs
(Contract F33615-74-C-2039; AF Proj. 3145)
(AD-A021642; AFAPL-TR-75-87-Pt-1) Avail: NTIS CSCL 10/2

This report presents a detailed study of alternator modeling, including numerical problems of simulation, a review of parameter estimation techniques, and analysis of the sensitivity of machine outputs to deviations of parameters. Author (GRA)

N76-29732# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
BUILDING ENERGY AUTHORITY AND REGULATIONS SURVEY: STATE ACTIVITY Final Report
Robert M. Eisenhard Jan. 1976 52 p Sponsored in part by ERDA
(PB-250858/8; NBSIR-76-986) Avail: NTIS HC $4.50 CSCL 13A

This report provides information on the status of State authority to regulate energy use in new buildings and the status of bills creating such authority that were pending in the 1975 legislative session. Regulations that have been developed are identified and described. Legislation relating to solar energy, retrofitting, insulation and other building energy matters, is identified and the status indicated. GRA

N76-29733# Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
AN ASSESSMENT OF TECHNIQUES FOR HYDROTHERMAL PREDICTION
Gerhard H. Jirka, Gerrit Abraham, and Donald R. F. Harleman Apr. 1975 421 p refs

(Contract AT(11-1)-2374)
(PB-250509/7; NUREG-0044) Avail: NTIS HC $11.00 CSCL 13B

The report provides a critical assessment of technique - both mathematical models and experimental methods - to predict temperature distribution in the water environment resulting from waste heat releases from steam-electric generation. Such predictions constitute an integral part of environmental impact assessment of power plant facilities. Different types of receiving waters and discharge modes are discussed. Types of receiving waters include lakes, rivers, estuaries, coastal waters and cooling ponds; discharge modes are surface and submerged discharges. Mathematical models are evaluated in regard to their physical validity, degree of field or laboratory verification and computational utility. Author (GRA)

N76-29734# Informatics, Inc., Rockville, Md.
GEOTHERMAL ENERGY Scientific Interim
Vlastimir A. Stevovich 15 Nov. 1975 531 p refs
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A022054) Avail: NTIS CSCL 08/7

This is a comprehensive review of present major developments and future planning in various fields of applied geothermal engineering. The study covers theoretical and experimental data on the background and state-of-the-art of applied geothermal research in general, with emphasis on foreign work. GRA

N76-29735# Army Electronics Command, Fort Monmouth, N.J.
DETERMINATION OF THE STATE OF DISCHARGE OF LITHIUM/ORGANIC ELECTROLYTE/GRAPHITE FLUORIDE CELLS
Herbert F. Hunger and Joseph E. Ellison Mar. 1976 19 p refs
(DA Proj. 1T1-61102-AH-47)
(AD-A021977; ECOM-4391) Avail: NTIS CSCL 10/3

The state of discharge of lithium/organic electrolyte/graphite fluoride cells can be determined non-destructively by measuring the cell voltage rise after termination of the load current. For a given cell design and geometry, the average error in determining the state of discharge amounted to 7.8% for a current density range of 0.2 - 2.0 mA/sq cm for both continuous or intermittent operation. Kinetic parameters, such as cathodic polarization or exchange current at the cathode, are suited for determining the state of discharge only under limited conditions of operation. Author (GRA)

N76-29736# Tetra Tech, Inc., Arlington, Va.
SUMMARY OF NATO SYNTHETIC FUEL ALTERNATIVES
Glen Tomlinson 27 Jan. 1975 31 p refs
(Contract N00014-74-C-0348)
(AD-A022081; TETRAT-A-642-75-158) Avail: NTIS CSCL 21/4

In the past year, the problem of natural crude supply (and its cost) has reached critical proportions for the United States and Western Europe. In view of this crisis the NATO countries have been forced to consider such alternative fossil fuel sources as coal, oil shale, and tar sands for their military forces. The use of these fuels does not present a problem of supply, for the NATO nations have deposits of these fossil fuels that far exceed the proven world reserves of crude oil. It does, however, present a problem of technology - how to realize and use effectively the synthetic product of these deposits. Coal, for example, is particularly plentiful, exceeding the NATO oil reserves and oil shale and tar sands resources by almost a factor of ten. NATO naval forces are affected by the fuel shortage and cost since most NATO naval ships and all its aircraft use liquid hydrocarbon fuels; the requirement for large quantities of liquid fossil fuels will continue for at least the next 25 years. Consequently, the military forces of NATO are particularly interested in the development of other sources and production methods for liquid fossil fuels. Conversion technologies for producing liquid fuel products from oil shale and coal have been demonstrated, a commercial tar sands plant is currently in operation in Canada, and several research and development programs are being conducted to improve the conversion process and to reduce the cost of synthetic fuels. The improved oil shale and coal conversion processes are now entering the pilot plant stage; commercial oil shale plants are expected to begin operation by 1980 and commercial coal liquefaction plants should begin operation by 1985. GRA

N76-29331* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PERFORMANCE FLAT PLATE SOLAR COLLECTOR
F. L. Lansing and R. Reynolds *In its* The Deep Space Network 15 Aug. 1976 p 90-99 refs (For availability see N76-29318 20-12)
CSCL 10A

N76-29337* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMIC MODELING FOR EVALUATION OF SOLAR COLLECTOR PERFORMANCE
C. L. Hamilton *In its* The Deep Space Network 15 Aug. 1976 p 141-146 refs (For availability see N76-29318 20-12)
CSCL 10A

N76-29338* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TOWARD A MATHEMATICAL MODEL OF SOLAR RADIATION FOR ENGINEERING ANALYSIS OF SOLAR ENERGY SYSTEMS
C. L. Hamilton and M. S. Reid *In its* The Deep Space Network 15 Aug. 1976 p 147-151 refs (For availability see N76-29318 20-12)
CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-29737# Committee on Public Works (U. S. House).
THE EFFECTS OF POLLUTION ABATEMENT ON INTERNATIONAL TRADE, 2
Washington GPO 1974 62 p refs 2d Rept. of the Secretary of Commerce to the President and Congress in compliance with Section 6 of the Federal Water Pollution Control Act, amendments of 1972, Public Law 92-500, 93d Congr., 2d Sess., Jul. 1974
(GPO-36-481; AR-2) Avail: Comm. on Public Works

The central task in Section 6 of Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972, is the identification of costs incurred by domestic and foreign manufacturers for pollution abatement. The study was initiated for the purpose of evaluating the effect of inequities in this area on international trade. The efforts of government agencies to collect and report environmental cost and control information are discussed. Methodologies were sought to identify priority industries and products for direct examination of pollution control costs. Techniques were also sought to extend limited cost data to the indirect determination of impacts on trading partners. D.M.L.

N76-29738*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METEOROLOGICAL ADJUSTMENT OF YEARLY MEAN VALUES FOR AIR POLLUTANT CONCENTRATION COMPARISON
Steven M. Sidik and Harold E. Neustadter Washington NASA Jul. 1976 43 p refs
(NASA-TN-D-8253; E-8628) Avail: NTIS HC $4.00 CSCL 13B

Using multiple linear regression analysis, models which estimate mean concentrations of Total Suspended Particulate (TSP), sulfur dioxide, and nitrogen dioxide as a function of several meteorologic variables, two rough economic indicators, and a simple trend in time are studied. Meteorologic data were obtained and do not include inversion heights. The goodness of fit of the estimated models is partially reflected by the squared coefficient of multiple correlation which indicates that, at the various sampling stations, the models accounted for about 23 to 47 percent of the total variance of the observed TSP concentrations. If the resulting model equations are used in place of simple overall means of the observed concentrations, there is about a 20 percent improvement in either: (1) predicting mean concentrations for specified meteorological conditions; or (2) adjusting successive yearly averages to allow for comparisons devoid of meteorological

effects. An application to source identification is presented using regression coefficients of wind velocity predictor variables.
Author

N76-29739# Brookhaven National Lab., Upton, N.Y.
INDIVIDUAL AIR POLLUTION MONITORS: AN ASSESSMENT OF RESEARCH NEEDS
M. G. Morgan (Carnegie-Mellon Univ.) and S. C. Morris 1975 7 p refs Presented at the IEEE Intern. Conf. on Environmental Sensing and Assessment, Las Vegas, Nevada, 15 Sep. 1975
(BNL-20546; Conf-750963-3) Avail: NTIS HC $4.50

In July of 1975, the Biomedical and Environmental Assessment group at Brookhaven National Laboratory convened a workshop titled Assessment of Research Needs in Individual Air Pollution Monitors for Ambient Air. The objectives were to develop: an estimate of how health effects experts would use individual air pollution monitors, a description of candidate instrumentation techniques, a first order evaluation of the promise held by these techniques, and a set of recommendations of national research needs in the field of individual air pollution monitors. On the basis of the data developed it is concluded that a national R and D investment totaling between 7.5 and 8 million dollars over the next five years will adequately meet our current needs for the development of individual air pollution monitors.
Author (ERA)

N76-29740# Sandia Labs., Albuquerque, N.Mex.
SANDIA LABORATORIES ENVIRONMENT AND SAFETY PROGRAMS
B. D. Zak, P. E. McGrath, and C. A. Trauth, Jr. 1975 13 p Presented at the 3d Environ. Protect. Conf., Chicago, Ill., 23 Sep. 1975 Sponsored by ERDA
(SAND-75-5656; Conf-750967-8) Avail: NTIS HC $4.00

Sandia, one of ERDA's largest laboratories, is primarily known for its extensive work in the nuclear weapons field. In recent years, however, Sandia's role has expanded to embrace sizeable programs in the energy, resource recovery, and the environment and safety fields. In this latter area, Sandia has programs which address nuclear, fossil fuel, and general environment and safety issues. Here, surveyed are ongoing activities, and described in more detail a few projects of particular interest. These rang from a study of the impact of sealed disposal of radioactive wastes, through reactor safety and fossil fuel plume chemistry, to investigations of the composition and dynamics of the stratosphere.
Author (NSA)

N76-29741# Massachusetts Inst. of Tech., Cambridge.
DESIGN AND IMPLEMENTATION OF A DEMONSTRATION SUPPLEMENTARY CONTROL SYSTEM Progress Report, 1 Aug. 1974 - 31 May 1975
M. Ruane and B. Greene 1975 64 p refs
(Contract AT(11-1)-2428)
(COO-2428-4; PR-2) Avail: NTIS HC $5.50

A Supplementary Control System (SCS) for maintaining acceptable ambient air quality was designed. The controlled pollutant is sulfur dioxide and the SCS design includes a real-time meteorology and air quality monitoring network, periodic weather forecasting, air quality modeling and a probabilistic control strategy. Four coal burning power plants (4800 MW) in the complex terrain near Chestnut Ridge in western Pennsylvania are controlled by the design, and control actions include fuel switching, load shifting and stack gas temperature modification. The design has been implemented and is beginning its field testing period. Nine months of field data have been collected by the monitoring system and several programs have been developed to sort and analyze the data. The 24 hour standard is threatened most frequently and the background influence of Pittsburgh and Johnstown can be significant.
ERA

N76-29742# United Kingdom Atomic Energy Authority, Harwell (England).
ATMOSPHERIC PHOTO-OXIDATION REACTIONS. THE GAS PHASE REACTION OF OH RADICALS WITH SOME SULFUR COMPOUNDS
R. A. Cox Aug. 1975 19 p refs
(AERE-R-8132) Avail: ERDA Depository Libraries HC $4.50; UK £1.00

The effect of added dimethyl sulfide, methyl mercaptan, carbonyl sulfide and hydrogen sulfide on the photolysis of nitrous acid in air at 1 atm pressure and room temperature was studied. The results enable evaluation of the relative rates of reaction of OH radicals with these sulfur compounds and give some insight into the nature of the reactions which follow OH attack, under conditions relevant to the lower atmosphere. The rates of oxidation of these sulfur compounds in the atmosphere are estimated on the basis of the observed reaction rates.
Author (ERA)

N76-29743# Commissariat a l'Energie Atomique, Saclay (France). Dept. de Protection.
APPLICATION OF ELECTRONIC MICROSCOPY TO THE STUDY OF FINE ATMOSPHERIC AEROSOLS Ph.D. Thesis - Brest Univ., 1975
J. F. Butor Jan. 1976 92 p refs In FRENCH
(CEA-R-4709) Avail: ERDA Depository Libraries HC $5.00

In order to specify size properties and nature of atmospheric aerosols, a method allowing the study of both Aitken nuclei and mean particle was chosen. An Anderson impactor collecting bigger dust particles and a downstream nuclepore filter were used. Deposits were studied with a transmission electron microscope. Apparatus, collecting, and analysis methods are described. Particle size distribution was formulated mathematically and the experimental results allowed to determine the characteristics of the materials used (Anderson impactor and the nuclepore filter collection efficiency). Finally, the nature of the aerosols observed at Brest, Ouessant or in the Atlantic Ocean off Azores was studied and statistical analysis was made of particle size distribution in various places with various meteorological conditions.
Author (NSA)

N76-29744# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
FLARE SYSTEMS STUDY Final Report, Aug. 1974 - May 1975
M. G. Klett and J. B. Galeski Mar. 1976 131 p refs
(Contract EPA-68-02-1331)
(PB-251664/9; LMSC-HREC-TR-D390190;
EPA-600/2-76-079) Avail: NTIS HC $6.00 CSCL 13B

Industrial flare technology for control of gaseous combustible emissions from stationary sources is reported. An evaluation of present engineering technology, evaluation of existing flare systems, assessment of present practices and problems, determination of major sources, and development of research recommendations including potential applications are discussed. Emissions data is summarized, and emission factors for hydrocarbon waste streams, based on limited available data are investigated. Potential problems which may affect design and component selection are discussed.
Author (GRA)

N76-29745# Industrial Environmental Research Lab., Research Triangle Park, N. C.
TENTATIVE PROCEDURES FOR PARTICLE SIZING IN PROCESS STREAMS: CASCADE IMPACTORS Final Report, Dec. 1973 - Nov. 1975
D. Bruce Harris Feb. 1976 63 p refs
(PB-250375/3; EPA-600/2-76-023) Avail: NTIS HC $4.50 CSCL 13B

Procedures for the field use of inertial impactors to determine particle size distributions from industrial particulate sources are discussed. It is emphasized that this document is for guidance only, and is not a set of rules. The preliminary survey, the sampling apparatus, testing procedures, and data analysis are included. The information applies to cascade impactors in general. Specific commercial impactors are discussed.
GRA

N76-29746# Geological Survey, Reston, Va. Water Resources Div.
MIX2: A COMPUTER PROGRAM FOR MODELING CHEMICAL REACTIONS IN NATURAL WATERS Final Water-Resources Investigations
L. Niel Plummer, David L. Parkhurst, and David R. Kosiur (Calif. Univ.) Dec. 1975 73 p refs
(PB-251668/0; USGS-WRI-75-61; USGS-WRD/WRI-76-016) Avail: NTIS HC $4.50 CSCL 07D

MIX2 is a FORTRAN IV computer program that utilizes an aqueous model and the constraints of mass balance and electrical balance to compute the pH and equilibrium distribution of inorganic

species as a result of net reaction progress in the closed system: CaO-MgO-Na2O-K2O-CO2-H2SO4-H2O. The program considers three general classes of problems involving net reaction progress: (1) mixing of two solutions in fixed volume (2) titration of one solution into another (variable volume), and (3) the addition or subtraction of a net stoichiometric reaction to or from an aqueous solution. In addition MIX2 will follow one phase boundary through any of the above classes of problems. This report presents the theory and method of calculation used by MIX2, describes the input to the program, presents results of two test cases, and provides a program listing. GRA

N76-29747# Argonne National Lab., Ill. Energy and Environmental Systems Div.

AIR QUALITY ANALYSIS WORKSHOP. VOLUME 2: EXECUTIVE SUMMARY Final Report

R. R. Cirillo, T. F. Tschanz, and A. E. Smith Feb. 1976 39 p refs

(PB-251684/7; EPA-450/3-75-080b-Vol-2) Avail: NTIS HC $4.00 CSCL 13B

The Executive Summary is intended to provide air quality management and planning officials with an assessment of 7 regional air quality analysis workshops held between November 24 and December 19, 1975. The major emphasis of the workshops was on analytical and technical procedures rather than on policy. They were designed to cover the entire scope of an air quality analysis, using a fictitious county, based primarily on Fulton County, Georgia, to illustrate the procedures.

Author (GRA)

N76-29748# Acres American, Inc., Buffalo, N. Y.

COST ESTIMATING METHODOLOGY FOR ONCE-THROUGH COOLING WATER DISCHARGE MODIFICATIONS Final Report, Jun. 1974 - Jun. 1975

John W. Hayden and Richard Mayer Mar. 1976 318 p refs (Contract EPA-68-03-2053)

(PB-251663/1; EPA-600/2-76-078) Avail: NTIS HC $9.75 CSCL 13A

The report gives a methodology for evaluating the engineering and cost implications of constructing or modifying once-through cooling water discharge systems of thermal-electric generating plants within the contiguous U.S. The procedures give (to persons not skilled in cost engineering) a means of preparing preliminary cost estimates from conceptual or design drawings. The user should, however, have a technical background and be familiar with once-through cooling water discharge systems. Principal construction elements of discharge system construction and modification are identified and grouped into categories. Materials and installation methods are discussed for each construction element. Data are given on labor, materials, equipment, and productivity assumed in unit cost development. A step-by-step procedure is given for: (1) estimating construction costs, and (2) resolving construction costs into project and annual costs. An example is shown using the methodology; the result is compared with actual construction costs for modifications to an existing discharge system. Author (GRA)

N76-29749# Aeronutronic Ford Corp., Newport Beach, Calif.

MONITORING NO AND CO IN AIRCRAFT JET EXHAUST BY A GAS-FILTER CORRELATION TECHNIQUE Final Report, 3 Mar. 1975 - 14 Jun. 1976

David A. Gryvnak and Darrell E. Burch Wright-Patterson AFB, Ohio AFAPL Jan. 1976 71 p refs

(Contract F33615-75-C-2038)

(AD-A022353; U-6179; AFAPL-TR-75-101) Avail: NTIS CSCL 07/4

The exhaust from jet engines contains many pollutant gas species. At the present time a convenient, reliable method is needed to monitor their concentrations. There are many different methods available for determining concentrations of pollutant gases in the effluent from smokestacks, aircraft, automobiles and other pollutions sources. Each method has its merits and its difficulties depending on the application. A class of instruments employing gas-cell correlation spectroscopy to provide good sensitivity and specificity at relatively low cost has been developed for a variety of applications. An infrared instrument using a gas-filter correlation technique was used to in-situ monitor NO and CO in the exhaust plume of a T56 jet engine combustor. The instrument, built previously by Aeronutronic Ford for EPA to monitor pollutant gases in smokestack exhausts, was modified for use on the combustor. Temperatures and concentrations ranged from 300 to 930K and up to 130 ppm for NO; for CO from 300 to 550K and up to 220 ppm. Optical results were obtained simultaneously by withdrawing the sample using probe techniques and analyzing the gas with a conventional gas analyzer. GRA

N76-29750# Illinois Univ., Urbana. Dept. of Civil Engineering.

FUNDAMENTAL STUDY ON THE POST TREATMENT OF RO PERMEATES FROM ARMY WASTE-WATERS Annual Report, 1 Jul. 1974 - 30 Jun. 1975

E. S. K. Chian and Powell P. K. Kuo Oct. 1975 141 p refs (Contract DAMD17-75-C-5006)

(AD-A021476; UILU-ENG-75-2026; AR-1) Avail: NTIS CSCL 07/1

The objective of the first year of this study was to investigate the removal of organic matter in MUST hospital wastewater after the reverse osmosis (RO) process by treatment with ozone, activated carbon and ion-exchange resins for potential reuse of the effluents. The major tasks completed during the first year of this study are as follows: (1) extensive study on the removal of organic matter in MUST wastes after RO process by treatment with ozone, activated carbon, and ion-exchange resins; (2) evaluation of the effect of biological pretreatment of MUST wastewater on the removal of organics by UF-RO-O3 processes; (3) development of the stripping and the distillation techniques for the analysis of volatile organic compounds present in RO permeates; (4) development of solvent extraction coupled with high pressure liquid chromatography (HPLC) technique for the analysis of nonvolatiles. GRA

N76-29751# RRC International, Inc., Latham, N. Y. Chemical and Environmental Processes Dept.

ABATEMENT OF NITROGEN OXIDES EFFLUENT FROM THE 50 mw HYPERSONIC TEST LEG ELECTROGASDYNAMICS FACILITY Final Report, May - Nov. 1974

Laurence K. Burnell and James D. Hyde Sep. 1975 151 p refs

(Contract F33615-74-C-3076; AF Proj. 1997)

(AD-A022280; AFFDL-TR-75-46) Avail: NTIS CSCL 13/2

Methods for the abatement of nitrogen oxides from the Facility were evaluated technically and economically. Methods previously tested by AFFDL were reviewed. New methods considered included: absorption, adsorption, catalytic decomposition and reduction, dispersion from tall stacks, entrapment, gas phase reactions, and thermal reduction methods including controlled cooling and flame incineration in the boilers. Evaluations were based on scientific and technical literature as well as personal contacts and in-house computer simulations. A selective catalytic reduction method using ammonia as the reductant over a zeolite catalyst was recommended. A subsequent report will be issued detailing design criteria for the application of this method to the Facility. GRA

N76-29752# Wapora, Inc., Washington, D. C.

ASSESSMENT OF INDUSTRIAL HAZARDS WASTE PRACTICES, PAINT AND ALLIED PRODUCTS INDUSTRY, CONTRACT SOLVENT RECLAIMING OPERATIONS, AND FACTORY APPLICATION OF COATINGS Final Report

Francis Scofield, James Levin, Gene Beeland, and Tony Laird Sep. 1975 304 p refs

(Contract EPA-68-01-2656)

(PB-251669/8; EPA-530/SW-119C) Avail: NTIS HC $9.75 CSCL 11C

Hazardous waste practices in the paint and coatings industries, and solvent reclaiming operations are described. Site surveys of 70 paint plants showed that raw materials packaging, cleaning wastes, dust from air pollution abatement equipment, and waste products are the major process wastes which are generated. Approximately 105,000 tons per year are potentially hazardous. The vast majority of the wastes are combined in a single waste handling system and discarded in off-site landfills. Operators reclaim about 270 kkg (300,000 tons) per year of waste organic solvents generated by the manufacture of paint and coatings, metals finishing, degreasing operations, etc. Distillation and

evaporation units generate still bottoms as a process waste which represents roughly 25 percent of the feedstock. Most of the still bottoms is incinerated with the ash deposited in landfill. GRA

N76-29753# System Innovation and Development Corp., Rolling Hills Estates, Calif.
MOBILE LIDAR STUDY OF THE LOS ANGELES MIXING LAYER Final Report
David T. Liu Feb. 1976 239 p
(Contract EPA-68-02-1305)
(PB-251723/3; EPA-600/4-76-009) Avail: NTIS HC $8.00 CSCL 13B

A mobile Lidar system, mounted in a van, was used to depict the temporal and spatial variations of the mixing depth over the Los Angeles Basin, during the LARPP field tests in the fall of 1973. Lidar profiles are interpreted and compared to vertical temperature and moisture profiles measured by helicopter and standard meteorological sounding techniques. Lidar echo anomalies are classified into mixing layer height or significant levels based on backscatter slop evaluation. The qualitative aspects of each backscatter signature are used in describing the nature and altitude of inversion bases, moisture layers, stratus and fog layers. GRA

N76-29754# Stanford Research Inst., Menlo Park, Calif.
INFORMAL WORKING PAPERS FOR THE REPORT: ALTERNATIVE FUTURES FOR ENVIRONMENTAL POLICY PLANNING, 1975 - 2000
David C. MacMichael, Duane S. Elgin, and Peter Schwartz Aug. 1975 374 p refs
(Contract EPA-68-01-2698)
(PB-251699/5; EPA-540/9-76-008) Avail: NTIS HC $10.50 CSCL 13B

These working papers are provided for use by the client in its development of a futures planning capability. This volume consists of three major sections: Section I: An extended discussion of the alternative futures methodology; Section II: A review of key trend areas which were critical in developing a plausible range of alternative futures scenarios; Section III: A review of selected futures literature which provided a multi-dimensional source of competing perspectives which, in turn, aided us in putting some 'flesh' on the skeletal futures that were developed. GRA

N76-29755# Radian Corp., Austin, Tex.
SAMPLING AND ANALYTICAL STRATEGIES FOR COMPOUNDS IN PETROLEUM REFINERY STREAMS. VOLUME 2: ANALYSIS OF PETROLEUM REFINERY STREAMS Final Report, May - Aug. 1974
K. J. Bombaugh, E. C. Cavanaugh, J. C. Dickerman, S. L. Keil, and T. P. Nelson Jan. 1976 196 p refs
(Contract EPA-68-02-1882)
(PB-251745/6; EPA-600/2-76-012b-Vol-2) Avail: NTIS HC $7.50 CSCL 07A

This report describes an actual test study to determine from available literature and through engineering analysis the potentially hazardous components in five selected effluents from a typical refinery. The streams were selected as typical major contributors to the total refinery emissions. They are representative of the different types of refinery effluents that might be encountered. The following are the five streams studied: fugitive atmospheric emissions from atmospheric crude distillation; aqueous condensate from the atmospheric crude still; effluent water from the API separator; tail gas from the sulfur recovery unit; and atmospheric emissions from the fluid catalytic cracking regenerator. Author (GRA)

N76-29756# Radian Corp., Austin, Tex.
ELECTRICAL ENERGY AS AN ALTERNATE TO CLEAN FUELS FOR STATIONARY SOURCES. VOLUME 2: APPENDIX Final Report, Jun. 1974 - Oct. 1975
R. M. Wells and W. E. Corbett Mar. 1976 476 p refs 2 Vol.
(Contract EPA-68-02-1319)
(PB-251830/6; EPA-600/2-76-049b-Vol-2) Avail: NTIS HC $12.50 CSCL 08I

The energy consumed by the metal, chemical, petroleum, food, paper, and glass industries is summarized along with the technology and environmental impacts associated with coal mining, oil shale mining, gas recovery, coal cleaning, coal gasification and liquefaction, petroleum refining, steam electric power generation, and rail and pipeline transportation. Author (GRA)

N76-29757# Gillette Research Inst., Inc., Rockville, Md.
AMMONIA REMOVAL FROM WASTEWATER BY LIGAND EXCHANGE Final Report
Lloyd M. Smith, George A. Lyerly, and Marilyn E. Dooley Apr. 1976 79 p refs
(Contract EPA-68-03-0455)
(PB-251418/0; EPA-600/2-76-103) Avail: NTIS HC $5.00 CSCL 13B

A ligand exchanger consisting of copper ions retained on a hydrous zirconium oxide ion exchanger was examined. Its ability to remove ammonia and subsequent regeneration with low pressure steam was evaluated. Initially, the capacity of the hydrous zirconium oxide for copper was examined to determine the conditions for maximum copper loading. The capacity of this ligand exchanger for ammonia at various pH's was measured. The effect of temperature and time on steam regeneration of the exhausted exchanger was obtained. The effect of specific inorganic ions on the process and the effect of organics on the ligand exchange process with steam regeneration was investigated. Exchange capacity after repeated loading and recyling was measured. Finally, the process performance was demonstrated using lime clarified, secondary municipal effluent. Author (GRA)

N76-29758# Little (Arthur D.), Inc., Cambridge, Mass.
LITERATURE STUDY OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS, ANTIMONY AND ITS COMPOUNDS Final Report
Feb. 1976 163 p refs
(Contract EPA-68-01-3198)
(PB-251438/8; ADL-C-78341; EPA-560/2-76-002) Avail: NTIS HC $6.75 CSCL 06T

A comprehensive review of the literature was conducted to prepare this preliminary investigation report on the physical and chemical properties of antimony (Sb) and its compounds, on the environmental factors related to their consumption and use, on the health and environmental effects resulting from exposure to Sb and antimonials, and on the regulations and standards governing their use. Antimony dusts have been associated with the development of pneumoconiosis in miners and other workmen. Some antimony compounds are toxic, or give rise to toxic decomposition products, but no serious occupational poisoning has been associated with the industrial use of antimony. GRA

N76-29759# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR US COAST GUARD AIRCRAFT POLLUTION PATROLS M.S. Thesis
Jerald Howard Heinz Dec. 1975 144 p refs
(AD-A021785) Avail: NTIS CSCL 13/2

The purpose of this thesis is to examine the present data collected and to evaluate its usage in respect to water pollution detection by Coast Guard aircraft patrols. It was found that, in general, more detailed and specific information is needed about the patrols. A system for collecting this new data and linking it to the present Pollution Incident Reporting System data base is proposed. The proposed system would allow evaluation of patrols at more specific areas and levels instead of the present district, coast and nationwide levels. Policy decisions could then be more specifically oriented to an area and/or the individual air station. GRA

N76-29760# Naval Coastal Systems Lab., Panama City, Fla.
VIRUS ELIMINATION IN WATER AND WASTEWATER
L. B. Katzenstein and J. A. Braswell Jan. 1976 42 p refs
(AD-A021773; NCSL-269-76) Avail: NTIS CSCL 13/2

The effectiveness of various techniques for disinfecting sewage and drinking water is discussed. Special emphasis is given to the elimination of viruses. Basic concepts of water and wastewater treatment such as coagulation, filtration, ozonation, and chlorination are reviewed. Information is presented on economically feasible methods for improving virus removal through the

application of new technology to conventional treatment techniques. Author (GRA)

N76-29761# Midwest Research Inst., Kansas City, Mo.
EVALUATION OF TURBULENT AGGLOMERATION FOR FINE PARTICLE CONTROL Final Report
K. P. Ananth and L. J. Shannon Mar. 1976 16 p refs
(Contract EPA-68-02-1324)
(PB-251431/3; EPA-600/2-76-066) Avail: NTIS HC $3.50 CSCL 13B

The report gives results of an evaluation of the potential of turbulent agglomeration in enhancing fine particulate control. Available information on theoretical and experimental aspects of turbulent agglomeration indicates that this is not a very viable approach for improving fine particle control. GRA

N76-29762# Midwest Research Inst., Kansas City, Mo.
EVALUATION OF THERMAL AGGLOMERATION FOR FINE PARTICLE CONTROL Final Report
K. P. Ananth and L. J. Shannon Mar. 1976 19 p refs
(Contract EPA-68-02-1324)
(PB-251432/1; EPA-600/2-76-067) Avail: NTIS HC $3.50 CSCL 13B

Results are given of an evaluation of the potential of thermal agglomeration as a means of enhancing the collection of fine particle emissions. Available theoretical and experimental information indicates that this method of particle agglomeration offers no useful avenue for improving fine particle control. GRA

N76-29763# Research Triangle Inst., Research Triangle Park, N.C.
VEGETATIVE STABILIZATION OF MINERAL WASTE HEAPS Final Report
R. P. Donovan, R. M. Felder, and H. H. Rogers Apr. 1976 318 p refs
(Contract EPA-68-02-1325)
(PB-252176/3; EPA-600/2-76-087) Avail: NTIS HC $9.75 CSCL 08I

The establishment of vegetative cover as a candidate method for reclaiming mineral ore waste heaps was studied. The location and properties of spoils and tailings from mining and ore benefication, and present methods for controlling dust emissions from them are described. Fundamentals for establishing vegetative cover, and a detailed review of case histories of both successful and unsuccessful revegetation are presented. A catalog of individual plant species is included. GRA

N76-29764# Pacific Environmental Services, Inc., Santa Monica, Calif.
CALCULATION OF EMISSION FACTORS FOR AGRICULTURAL BURNING ACTIVITIES Final Report
L. G. Wayne and M. L. McQueary Nov. 1975 68 p refs
(Contract EPA-68-02-1004)
(PB-251555/9; EPA-450/3-75-087) Avail: NTIS HC $4.50 CSCL 13B

Proposed revisions to the emission factors for burning of wine and orchard crops, weeds and forest residues activities given in AP-42, Compilations of Air Pollutant Emission Factors, are made. The data, calculations and supplemental information upon which the proposed emission factors are based are provided. GRA

N76-29765# Northwest Environmental Technology Labs., Inc., Bellevue, Wash.
FIELD TESTING AND EVALUATION OF METHODS FOR MEASURING VISIBILITY Final Report, 15 Jun. 1973 - 15 Apr. 1975
Russel Cwalinski, John M. Lansinger, and William G. Tank Apr. 1975 98 p refs
(Contract EPA-68-02-1209)
(PB-251548/4; EPA-650/2-75-039) Avail: NTIS HC $5.00 CSCL 13B

A field study which was conducted to evaluate four methods for determining visibility. Three methods employed instruments to obtain visibility related measurements: a telephotometer measuring contrast between 'black' targets and the horizon sky; a transmissometer measuring light extinction over a folded horizontal path of approximately one mile; and two integrating nephelometers measuring light scattering by aerosis in a local volume of air. One nephelometer was operated at a fixed location and the other on occasions at random locations. The fourth method used a trained observer estimating visibility in four compass directions, and was used as a standard for comparison. Measurements were made under a variety of meteorological conditions and results are classified by the range of relative humidity under which they were obtained. The results identify the telephotometer as the best choice of instrument for routine estimates of daylight visibility as an indicator of air quality. GRA

N76-29766# GCA Corp., Bedford, Mass. Technology Div.
COMPREHENSIVE ANALYSIS OF TIME-CONCENTRATION RELATIONSHIPS AND VALIDATION OF A SINGLE SOURCE DISPERSION MODEL Final Report
Michael T. Mills and Frank A. Record Apr. 1975 156 p refs
(Contract EPA-68-02-1376)
(PB-250814/1; GCA-TR-75-4-G; EPA-450/3-75-083) Avail: NTIS HC $6.75 CSCL 13B

The report presents an analysis of SO2 time concentration relationships in the vicinity of a power plant and a validation of the EPA Single Source model using concentration and meteorological data collected in the same area. The concentration relationships studied were peak 1-hour to average 3-hour and peak 1 hour to average 24-hour concentration ratio distributions and the effect upon the statistics of these distributions of variables such as wind speed, atmospheric stability, hour of the day, and peak 1-hour concentration itself. The principal finding of the validation exercise was that the model underpredicted SO2 concentrations for all 4 receptor locations in the study area. The agreement between measured and calculated concentrations was not noticeably improved by the use of more accurate and detailed emissions and meteorological data bases.
Author (GRA)

N76-29767# City Coll. of the City Univ. of New York. Dept. of Mechanical Engineering.
SUBMERGED THERMAL DISCHARGES
Latif M. Jiji and Joseph Hoch Aug. 1975 100 p refs
(Contract DI-14-31-0001-9008)
(PB-249996/0; OWRT-C-4040(9008); W76-04799; Rept-101) Avail: NTIS HC $5.00 CSCL 13B

Comprehensive analytical solutions to the trajectory, velocity and temperature distribution for various submerged jets are presented. The solutions take into consideration the effect of buoyancy, turbulence, discharge orientation and cross flow. The method of solution is based on an integral-moment technique in which closure is provided by an assumed turbulent Reynolds stress rather than an entrainment coefficient. The validity of this approach was established by comparing results of this theory with exact analytical solutions to laminar jets as well as numerous experimental data on various turbulent discharges. Agreement with experimental results was found to range from fair to excellent. Working charts are presented for a wide range of the Froude number, discharge angle and free stream to outlet velocity parameter. Author (GRA)

N76-29768# Radian Corp., Austin, Tex.
SULFUR DIOXIDE INTERFERENCES IN THE MEASUREMENT OF AMBIENT PARTICULATE SULFATES, VOLUME 1 Final Report
F. B. Meserole, K. Schwitzgebel, B. F. Jones, C. M. Thompson, and F. G. Mesich Jan. 1976 60 p refs Sponsored by the Elec. Power Res. Inst.
(PB-249620/6; EPRI-262-Vol-1) Avail: NTIS HC $4.50 CSCL 14B

The laboratory experiments described in the following report were designed to scope potential errors involved in the ambient sulfate determination utilizing high-volume (Hi-Vol) sampling procedures. Factors contributing to positive errors include filter type and residual sulfate in the filters. The greatest influence was found to be high ambient sulfur dioxide concentrations at low temperatures. Sulfur dioxide is sorbed on the filters and rapidly oxidized to sulfate. This mechanism, under certain conditions, leads to sulfate artifact formation comparable to values reported from ambient measurements. Author (GRA)

N76-29769# Development Planning and Research Associates, Inc., Manhattan, Kans.
WATER POLLUTION CONTROL ACT OF 1972. ECONOMIC IMPACTS FERTILIZER INDUSTRY Final Report
Nov. 1975 175 p refs
(Contract WQ5AC011)
(PB-250017/1; NCWQ-75/39) Avail: NTIS HC $6.75 CSCL 13B

Authors examine the economic impacts of the Federal Water Pollution Control Act Amendments of 1972 on the fertilizer industry (SIC 2873, 2874). Price increases of 1.5% or less can be expected as a result of BPT (best practicable treatment technology) pollution controls, while negligible increases in all but ammonium nitrate should result from BAT (best available technology) controls. Profits will be reduced for all plants installing pollution controls, but no plant will become unprofitable solely as a result of pollution controls. Small, older plants may close as a result of pollution controls, but will be replaced by larger, more modern plants. Employment, community and international trade impacts are expected to be relatively insignificant.
Author (GRA)

N76-29770# Midwest Research Inst., Kansas City, Mo.
EVALUATION OF ELECTROFLUIDIZED BED Final Task Report, Jun. 1974 - Jan. 1975
K. P. Ananth and L. J. Shannon Feb. 1976 31 p refs
(Contract EPA-68-02-1324)
(PB-250606/1; EPA-600/2-76-040) Avail: NTIS HC $4.00 CSCL 13B

The report gives results of an evaluation of the concept of using electro-fluidized beds for fine particle collection. A simple model was developed to describe the interaction between an aerosol stream and the bed material. Maximum predicted overall collection efficiencies range from 96% for a 1 micrometer aerosol particle to 85% for a 0.5 micrometer aerosol particle, with collector bodies of size 100 micrometers, an availability factor of 0.1, and fluidization velocities of 0.5 ft/sec. An increase in fluidization velocity or a decrease in collector number density (i.e., larger collector bodies) diminishes the overall collection efficiency for the conditions used in this investigation. The performance of the electrofluidized bed depends upon the interaction of the electrostatic forces and bed dynamics. The inherent instability of solids flow patterns in gas-fluidized beds may limit the collection efficiency that can be achieved. Author (GRA)

N76-29771# Booz-Allen and Hamilton, Inc., Bethesda, Md.
REGIONAL EMISSION PROJECTION SYSTEM (REPS) Final Report
Feb. 1975 139 p refs
(Contract EPA-68-02-1005)
(PB-250680/6; EPA-450/3-75-037) Avail: NTIS HC $6.00 CSCL 13B

This report describes the regional emission projection system (REPS) which is a computerized air pollution emissions projection model to project emissions at the AQCR level. It combines national and regional economic forecasts with point and area source inventories from the National Emissions Data System (NEDS) to project air pollution emission levels for the five criteria pollutants, on an annual basis, from the present to the year 2000. Portions of this document are not fully legible. Author (GRA)

N76-29772# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
ENVIRONMENTAL RESEARCH OUTLOOK FOR FY 1976 THROUGH 1980: REPORT TO CONGRESS
Feb. 1976 166 p
(PB-250523/8; EPA-600/9-76-003) Avail: NTIS HC $6.75 CSCL 13B

This report represents the first attempt by the Office of Research and Development (ORD) to present a 5-year overview of ORD's research program, priorities and trends. The report will be updated annually. This overview is broken into ORD's five major programs which are: Health and ecological effect; Industrial processes; Public service activities; Monitoring and technical support; and Energy/Environment. ORD's working agreements with other Federal Agencies are also briefly described. In the near-term ORD has given priority to strengthening the Health and Ecological Effects Program. Another priority area is the Industrial Processes Program where pollution control technology R&D is needed if the 1985 water quality goals are to be more closely met. Emphasis will also be placed on monitoring and quality assurance R and D which support Agency regulatory actions. Author (GRA)

N76-29773# National Bureau of Economic Research, Inc., New Haven, Conn.
WATER POLLUTION CONTROL ACT OF 1972. ECONOMIC IMPACTS PLANT CLOSURES Final Report
Jun. 1975 71 p
(Contract WQ4AC013)
(PB-250015/5; NCWQ-75/38) Avail: NTIS HC $4.50 CSCL 13B

Authors discuss the kinds of plants most likely to close as a result of the requirements of the Federal Water Pollution Control Act Amendments of 1972. A regional vulnerability analysis was used, which examined past trends in plants and regional growth. Six industries -- textiles, pulp and paper, petroleum refining, iron and steel, non-ferrous metals and electroplating -- are examined. Most highly impact will be the small plants, with fewer than 100 employees, and single branch plants.
Author (GRA)

N76-29774# Rockwell International Corp., Newbury Park, Calif. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY (RAPS) EMISSION INVENTORY HANDBOOK, VOLUME 3 Final Report
Feb. 1976 392 p refs
(Contract EPA-68-02-1081)
(PB-250114/6; EPA-600/3-76-011b-Vol-3) Avail: NTIS HC $10.75 CSCL 13B

The Regional Air Pollution Study encompasses the St. Louis air quality control region. Its aim is to obtain hourly data for key pollutants based insofar as possible, on measured values. Thus, emission data should be available for a base period of a year, commensurate in detail and accuracy with data on ambient concentrations and micrometeorological information gathered by the regional air monitoring stations. Volume 3 deals with railroad and highway line sources, emission models, validation methodology, field measurement validation, data handling, computer programming, and information transfer. GRA

N76-29775# Catalysis Research Corp., Palisades Park, N. J.
FEASIBILITY STUDY OF A PROCESS TO TREAT FLUE GASES FROM A RED WATER INCINERATOR Final Report
John Happel and M. A. Hnatow 1 Feb. 1976 39 p refs
(Contract DAAA21-74-C-0537)
(AD-A022037) Avail: NTIS CSCL 19/1

Data are presented to show that a rare earth based catalyst shows promise in application to the conversion of NOx and SOx from Red Water Incineration. CO is employed as a reducing agent to convert these pollutants to N2 and elemental sulfur respectively. Important advantages of the catalyst are ability to withstand poisoning by water and oxygen, and complete conversion to easily disposed products with no side production of carbonyl sulfide or hydrogen sulfide. A tentative plant design is proposed and an estimate of the economics involved in conversion of gases from incineration of the Red Water from a 50 T/day TNT plant. Author (GRA)

N76-29776# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 2: HEAVY-DUTY DIESEL ENGINES Final Report
Rod Pilkington, Tom Kelly, and Harold Wimette Jun. 1975 296 p refs
(Contract EPA-68-02-1740)
(PB-251332/3; EPA-650/4-75-024C) Avail: NTIS HC $9.25 CSCL 13F

Quality assurance guidelines for heavy-duty diesel engines mobile source emissions measurement systems are presented with the concept of a total Quality Assurance System. The guidelines apply to Quality Assurance Principles and techniques in the areas of procurement, standards and calibration, test quality control, data validation and corrective action. Model Quality Management Procedures are presented to describe the re-

lationships and responsibilities of the various organizational elements in accomplishing the quality functions. GRA

N76-29777# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 2: HEAVY-DUTY DIESEL ENGINES-TEST PROCEDURES Final Report
Rod Pilkington, Tom Kelly, and Harold Wimette Jun. 1975 185 p
(Contract EPA-68-02-1740)
(PB-251333/1; EPA-650/4-75-024d) Avail: NTIS HC $7.50 CSCL 13F

Test procedures for heavy-duty diesel engines mobile source emissions measurement systems are presented with the concept of a total quality assurance system. The test procedures are presented in document control format and give the detailed test procedures with quality assurance provisions for each part of the total testing system. GRA

N76-29778# Indiana Univ., Bloomington.
WATER QUALITY GUIDANCE: DEVELOPMENT OF RESIDUALS MANAGEMENT STRATEGIES. AN EXECUTIVE SUMMARY Socioeconomic Environmental Studies Series
Charles N. Ehler, Richard S. Howe, and Nicholas L. White Jan. 1976 31 p
(Grant EPA-R-803313)
(PB-251011/3; EPA-600/1-76-01a) Avail: NTIS HC $4.00 CSCL 13B

Strategies for managing the residuals that result from human activity are examined. Residuals - leftovers that inevitably result from all human activity - are often referred to as wastes or pollutants. The idea of residuals management includes both the concept of waste management and pollution control. Step by step guidelines for identifying alternate residuals management strategies and then evaluating and selecting a strategy are given. The selected strategy will provide decision makers with an economical and effective means of solving their problem. GRA

N76-29779# Indiana Univ., Bloomington.
WATER QUALITY GUIDANCE: DEVELOPMENT OF RESIDUALS MANAGEMENT STRATEGIES Socioeconomic Environmental Studies Series
Charles N. Ehler, Richard S. Howe, and Nicholas L. White Jan. 1976 90 p refs
(Grant EPA-R-803313)
(PB-251012/1; EPA-600/1-76-01b) Avail: NTIS HC $5.00 CSCL 13B

The purpose of the report is to provide a comprehensive and systematic approach for developing and evaluating strategies for residuals management. It is based on the concept that wastes (material and energy residuals) which adversely affect the environment are generated as a result of all human activity. GRA

N76-29780# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 3: LIGHT-DUTY DIESEL-POWERED VEHICLES - QUALITY ASSURANCE GUIDELINES Final Report
Harold Wimette, Rod Pilkington, and Tom Kelly Jun. 1975 24 p refs
(Contract EPA-68-02-1740)
(PB-251562/5; EPA-650/4-75-024e) Avail: NTIS CSCL 13F

Quality assurance guidelines for light duty diesel powered mobile source emissions measuremen systems are presented with the concept of a total Quality Assurance System. The guidelines apply to Quality Assurance principles and techniques in the areas of procurement, standards and calibration, test quality control, data validation and corrective action. Model Quality Management Procedures are presented to describe the relationships and responsibilities of the various organizational elements in accomplishing the quality functions. GRA

N76-29781# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 3: LIGHT-DUTY DIESEL-POWERED VEHICLES - TEST PROCEDURES Final Report
Harold Wimette, Rod Pilkington, and Tom Kelly Jun. 1975 28 p
(Contract EPA-68-02-1740)
(PB-251563/3; EPA-650/4-75-024f) CSCL 13F

Test Procedures for Light Duty Diesel Powered Mobile Source Emissions Measurement Systems are presented with the concept of a total Quality Assurance System. The Test Procedures are presented in document control format and give the detailed test procedures with Quality Assurance provisions for each part of the total testing system. This volume is a supplement to EPA-650/4-75-024-B, Guidelines for QA Programs for Mobile Source Emissions Measurement Systems, Phase 1, Light Duty Gasoline Powered Vehicles - Test Procedures. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-29782*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
A STUDY OF THE CONDITIONS NECESSARY FOR THE ONSET OF MID-LATITUDE SPREAD F
Gleb N. Zinchenko 3 Aug. 1976 46 p refs
(Grant NGL-39-009-003)
(NASA-CR-148597; PSU-IRL-SCI-445) Avail: NTIS HC $4.00 CSCL 04A

Ionospheric conditions associated with the initiation of spread F in the mid-latitude ionosphere were observed. The morphology of spread F at Puerto Rico was investigated. Data from 7 nights was examined for Arecibo, five with spread F and two without. The relative height of the F layer maximum and the vertically integreted Pedersen conductivity, the relation between E and F region conductivities, the coupling lengths between the E and F regions, and vertical and horizontal gradients of electron density were examined. At Millstone Hill 13 nights were examined for all of which spread F was observed. The EW and NS velocities and the vertical velocities and the electric ion temperature ratio were examined. Author

N76-29783*# Oregon Univ., Eugene. Dept. of Geology.
PETROGENESIS OF KREEP
G. A. McKay and D. F. Weill [1975] 75 p refs
(Grant NGL-38-003-002)
(NASA-CR-148583) Avail: NTIS HC $4.50 CSCL 08G

Solid/liquid distribution coefficients (weight basis) were experimentally determined for a number of trace elements for olivine, orthopyroxene, plagioclase and ilmenite. Values of distribution coefficients were measured at 1200 C and a f sub O2 of 10 to the -13.0 power for liquids similar in composition to the olivine-opx-plagioclase peritectic in the pseudoternary system (Fe,Mg)2SiO4-CaAl2Si2O8-SiO2. Values were also measured at 1140 C and a f sub O2 of 10 to the -12.8 power for liquids similar in composition to high-Ti mare basalts. Major and trace element partitioning and relevant phase equilibria were used to investigate possible parent-daughter relationships between a number of highland samples and highly evolved KREEP-rich materials. Out of about 80 highlands samples tested, 33 were found to be possible parents to the KREEP-rich materials. The average composition of these samples is very similar to that of the Low-K Fra Mauro basalt (LKFM). A model is proposed to explain the production of LKFM-type material and more evolved members of the KREEP suite. Author

N76-29784# Polish Academy of Sciences, Warsaw.
BOUNDARY EQUILIBRIUM OF EARTH SLOPES. A TRIAL SOLUTION OF SPATIAL PROBLEMS [ROWNOWAGA GRANICZNA SKARP ZIEMNYCH. PROBA ROZWIAZYWANIA ZAGADNIEN PRZESTRZENNYCH]
Malgorzata Wozniak 4 Nov. 1975 68 p refs In POLISH
Avail: NTIS HC $4.50

A solution of certain spatial boundary states in soils using the method of characteristics is proposed. The method was

developed for application to boundary equilibrium of earth slopes traced along any flat curve, but it can also be used in studying the boundary state of banks and other problems of plastic flow. The method is based on certain principles with respect to type of stress field and velocity field, examining three dimensional problems. Using the principles of prepared displacements and prepared changes of the stress state, the three dimensional problem is reduced to a single parametric family of two dimensional problems for the stress tensor fields and the flow velocity vector. The proposed approach is illustrated by examples of analytical solutions. Boundary equilibrium of soil surrounded by a vertical cylindrical holding wall running along any curve is examined. A second illustration is a three dimensional problem of profiling a slope. Author

N76-29785*# California Univ., Los Angeles. Dept. of Geophysics and Space Physics.
A THREE-DIMENSIONAL VISCOELASTIC MODEL OF A STRIKE SLIP FAULT
J. B. Rundle and D. D. Jackson [1975] 51 p refs
(Grant NsG-7002)
(NASA-CR-148584) Avail: NTIS HC $4.50 CSCL 08E

An analytic approximation to the Green's function for the displacements due to a strike slip point source in an elastic layer over a viscoelastic half-space is developed. This approximate Green's function is useful because it can be analytically integrated over the fault surface. Comparison with a numerical integration of the exact solution integral indicates that the approximation is quite good. The approximate Green's function is integrated analytically to obtain the displacements due to a finite rectangular strike slip fault in an elastic layer over a viscoelastic half-space. Ground displacements and angle changes from a model survey net are computed to illustrate the viscoelastic relaxation which follows a fracture in the elastic region. Author

N76-29786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRATEGIES FOR ESTIMATING THE MARINE GEOID FROM ALTIMETER DATA
P. Argentiero, W. D. Kahn, and R. Garza-Robles Washington NASA Jul. 1976 30 p refs
(NASA-TN-D-8285; G-7683) Avail: NTIS HC $4.00 CSCL 08E

Altimeter data from a spacecraft borne altimeter was processed to estimate the fine structure of the marine geoid. Simulation studies show that, among several competing parameterizations, the mean free air gravity anomaly model exhibited promising geoid recovery characteristics. Using covariance analysis techniques, quantitative measures of the orthogonality properties are investigated. Author

N76-29787*# California Univ., Los Angeles.
THERMAL AND MECHANICAL STRUCTURE OF THE UPPER MANTLE: A COMPARISON BETWEEN CONTINENTAL AND OCEANIC MODELS
C. Froidevaux (Paris Univ., Orsay), G. Schubert, and D. A. Yuen [1976] 39 p refs
(Grants NsG-7002; NSF GA-40749)
(NASA-CR-148599) Avail: NTIS HC $4.00 CSCL 08G

Temperature, velocity, and viscosity profiles for coupled thermal and mechanical models of the upper mantle beneath continental shields and old ocean basins show that under the continents, both tectonic plates and the asthenosphere, are thicker than they are beneath the oceans. The minimum value of viscosity in the continental asthenosphere is about an order of magnitude larger than in the shear zone beneath oceans. The shear stress or drag underneath continental plates is also approximately an order of magnitude larger than the drag on oceanic plates. Effects of shear heating may account for flattening of ocean floor topography and heat flux in old ocean basins. Author

N76-29788# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE RESPONSE OF FROZEN SOILS TO VIBRATORY LOADS
Henry W. Stevens Jun. 1975 105 p refs
(DA Proj. 4A1-62121-A-894)
(AD-A013831; CRREL-TR-265) Avail: NTIS CSCL 08/13

A laboratory test was conducted on prepared specimens of frozen soils in which a right circular cylinder was subjected to steady state sinusoidal vibration. The material was considered to be linearly viscoelastic. Analysis of test data based on one-dimensional wave propagation yielded the complex Young's modulus, the complex shear modulus, the phase velocity of wave propagation, the shear velocity, the damping property, an attenuation coefficient, and a complex Poisson's ratio. The frequency of vibration was varied from 500 to 10,000 Hz, and the peak dynamic stress was varied from 0.1 to 5.0 psi. Specimens were remolded or cored in-situ, frozen, and tested at temperatures of 0, 15 and 25 deg. A few tests were conducted on identical soils nonfrozen. Results from a limited number of tests on selected soils indicate that the stiffness of these soils varies with the volume of ice/volume of soil ratio, and that ice is less stiff than saturated frozen soils. Frozen soils have stiffnesses up to 100 times those of identical soil nonfrozen. Depending upon the degree of ice saturation, the stiffness of non-saturated frozen soils varies from that of the saturated soils to nearly that of the nonfrozen soils. Stiffness increases with decreasing temperature but the rate is relatively low. As temperature rises and approaches the freezing point, stiffness abruptly decreases. GRA

N76-29789# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AN ELECTRON-OPTICAL INVESTIGATION OF SOIL CLAY MINERALS AND SOIL STABILIZING AGENT REACTIONS Environmental Research Papers
P. Michael Terlecky, Jr., Rossman F. Giese, Jr., James L. Eades, and Robert Wolfe 14 Jul. 1975 39 p refs
(ILIR Proj. 2A-01)
(AD-A015738; AFCRL-ERP-523; AFCRL-TR-75-0374) Avail: NTIS CSCL 08/13

Experiments were conducted to determine the reactions between clay minerals and lime which was used as a soil stabilizing agent. Examination of clay minerals visually by use of the scanning electron microscope, offers a partial examination of the irreactivity with soil stabilizing agents. Both surface area and surface roughness increase while there is an apparent decrease in the crystallinity of the clay minerals examined. Reactions were studied of several soil clay minerals with various proportions of Ca(OH)2 and both with and without contact with the air. The major product of the reactions is calcite with smaller amounts of other oxide materials. Scanning electron microscopy of the reacted materials shows a rough, 'corroded' surface on the clays as well as the formation of small single crystals of calcite and Ca(OH)2. Experimental studies showed that the problems of swelling soils can be alleviated by a double application Ca(OH)2 under proper moisture conditions. Author

N76-29790# Kansas Univ., Lawrence. Remote Sensing Lab.
GROUND WAVE PROPAGATION OVER ARCTIC SEA ICE
Albert W. Biggs Aug. 1970 30 p refs
(Contract N62306-67-C-0044)
(AD-A021394; CRINC-TR-137-3) Avail: NTIS CSCL 20/14

Radio ground wave propagation in the Arctic Ocean occurs over mixed paths. The mixed paths include layered or homogeneous sea ice and sea water. Amplitude and phase variations occurring as 'dropoff' or 'recovery' effects at the ice-sea water boundaries provide a technique for sea ice mapping and an explanation for anomalous radio reception. The phase variations are more sensitive over short distances from the mixed path boundaries. GRA

N76-29791# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
DETERMINATIONS AND STATISTICAL STUDIES OF GRAVIMETRIC DEFLECTIONS Final Report, 16 May 1972 - 30 Jun. 1975
Leland T. Long Aug. 1975 65 p refs
(Contract DAAK02-72-C-0446; DA Proj. 4A7-62707-A-852)
(AD-A022293; ETL-0017) Avail: NTIS CSCL 08/5

The first purpose of this report is to document the computer programming of the gravimetric deflections from the vertical for a type III area. The type III area contains mountainous terrain with moderate to sharp gravity anomalies. The second purpose of this report is to compute vertical gravimetric deflection values on a 51 x 51 point grid with a 2.0 kilometer grid interval. The

grid is centered in northern New Mexico at 106.5 degrees W, 25.75 degrees N, and the area is a type III area. The third purpose of this report is to show that the analytical continuation used by Moritz can be performed by use of the Fourier transforms. For large data sets in a gridded format, the use of a fast Fourier transform algorithm could lead to more efficient computer programming of the equations of Moritz. GRA

N76-29792# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

SEASONAL VARIATIONS OF CHEMICAL CONSTITUENTS IN ANNUAL LAYERS OF GREENLAND DEEP ICE DEPOSITS

C. C. Langway, Jr., James H. Cragin, G. A. Klouda, and M. M. Herron Dec. 1975 10 p refs

(Grants NSF AG-212; NSF AG-394; NSF OPP-750-675-0675)

(AD-A021319; CRREL-RR-347) Avail: NTIS CSCL 08/12

Chemical analysis of century-old ice from continuous 5 to 7 year intervals of three ice cores from south and central Greenland (Dye 3, Milcent and Crete) show maximum concentrations of Na, Mg, Ca, K and Al during early spring and minimum concentrations during late summer and early fall. Peak spring values are as much as 10 times greater than fall values. Because of the large seasonal chemical variations, samples used for depth-age or annual deposition rate studies must represent accumulation from exactly one year or whole multiples of a year. The seasonal chemical variations seem promising as a new method of defining annual layers and thus dating old ice cores. Author (GRA)

N76-29793# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

A REVIEW OF ENGINEERING EXPERIENCES WITH EXPANSIVE SOILS IN HIGHWAY SUBGRADES Interim Report

Donald R. Snethen, Frank C. Townsend, Lawrence D. Johnson, David M. Patrick, and Philip J. Vedros Jun. 1975 139 p refs

(AD-A020309; FHWA-RD-75-48) Avail: NTIS CSCL 08/13

Volume change resulting from moisture variations in expansive soil subgrades is estimated to cause damage to streets and highways in excess of $1.1 billion annually in the United States. Expansive soils are so areally extensive within parts of the United States that alteration of the highway routes to avoid the material is virtually impossible. This report presents the results of a review of current literature combined with details of experiences of selected state highway agencies on procedures for coping with problems associated with expansive soil subgrades. The report discusses the geologic, mineralogic, physical, and physiochemical properties which influence the volume change characteristics of expansive soils. Currently used techniques for sampling, identifying, and testing expansive materials are reviewed and discussed. Treatment alternatives for the prevention or reduction of detrimental volume change of expansive soil subgrades beneath new and existing pavements are presented and discussed. Author (GRA)

N76-29794# California Research and Technology, Inc., Woodland Hills.

NUMERICAL ANALYSIS OF PROJECTILE IMPACT AND DEEP PENETRATION INTO EARTH MEDIA Final Report, 1 Dec. 1973- 30 Nov. 1974

M. H. Wagner, K. N. Kreyenhagen, and W. S. Goerke Aug. 1975 136 p refs

(Contract DACA39-74-C-0007)

(AD-A014142; CRT-2020-1; AEWES-CR-S-75-4) Avail: NTIS CSCL 08/13

A study was carried out to examine the utility, and some of the limitations, of using a finite difference Lagrangian code to analyze relatively deep penetrations of projectiles into earth media. Numerical solutions were obtained for the normal impact of an 8-in. dia, 602-lb steel ogival projectile at 2000 fps into a soil/shale layered target. Two types of analyses were performed. In the first, the soil response, penetration dynamics, and projectile response were analyzed as one problem. The projectile was treated as an elastic-plastic, or deformable body, in order to determine the internal stress response. In the second analysis, the projectile was treated as a rigid body, and its penetration to a depth of 22 ft was calculated. GRA

N76-29795# Cooperative Inst. for Research in Environmental Science, Boulder, Colo.

SEISMIC WAVE PROPAGATION AND EARTHQUAKE CHARACTERISTICS IN ASIA Semiannual Technical Report, 1 May - 31 Oct. 1975

Carl Kisslinger, E. R. Engdahl, Ming-te Lin, R. Herrmann, T. Hewitt, and G. Lundquist 31 Oct. 1975 127 p refs

(Grant AF-AFOSR-2775-75; ARPA Order 1827)

(AD-A020693; AFOSR-76-0122TR; SATR-2) Avail: NTIS CSCL 08/11

The effects of subduction zones on local and teleseismic network data for earthquakes in the North Pacific have been determined. Hypocenter location, focal mechanisms and slip vectors are all perturbed in ways that can be corrected by tracing seismic rays through appropriate models of the upper mantle. The matching of synthetic seismograms for the first 30 seconds of the long period P signal with observations at several azimuths yields depths of crustal events to within 10 km and reliable estimates of focal mechanisms and source time functions. Spectral estimates for body waves based on the autocorrelation function, with a Hanning window, are more reliable than those by the FFT algorithm. Station spectra can be corrected reasonably well for source crust and receiver crust effects, but the proper way to model attenuation remains a difficult problem. The use of a frequency-dependent modulation of T/Q has been tested and seems promising. GRA

N76-29796# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.

A GEOMAGNETIC DATA COLLECTION NETWORK Final Report, 1 Mar. 1972 - 30 Jun. 1975

Robert C. Snare 13 Nov. 1975 38 p refs

(Contract F19628-72-C-0175; AF Proj. 8601)

(AD-A020995; AFCRL-TR-75-0593) Avail: NTIS CSCL 08/14

The development of a data collection system and magnetic field instrumentation is described. GRA

N76-29797# Hawaii Inst. of Geophysics, Honolulu.

MAGNETIC AND BATHYMETRIC PROFILES FROM THE CENTRAL AND SOUTHEASTERN PACIFIC 10 DEG N-45 DEG S, 70 DEG W-150 DEG W

D. W. Handschumacher, S. T. Okamura, and P. K. Wong Nov. 1975 183 p refs

(Contract N00014-75-C-0209; Grant NSF IDO-71-04207; NR Proj. 083-603)

(AD-A021163; HIG-75-18; HIG-Data-29) Avail: NTIS CSCL 08/14

Magnetic and bathymetric survey data are presented in profile format along tracklines. Sources for these data are: Hawaii Institute of Geophysics, University of Hawaii; Pacific Oceanographic Laboratories, National Oceanic and Atmospheric Administration; Project Magnet, U.S. Navy Oceanographic Office; Lamont-Doherty Geological Observatory, Columbia University; and School of Oceanography, Oregon State University. Although tectonic interpretation of the data is not included, several features of the magnetic data analysis are discussed. GRA

N76-29798# Simon Fraser Univ., Burnaby (British Columbia).

GEOGRAPHIC DATA STRUCTURES

Thomas K. Peucker, ed., D. M. Mark, and J. L. Pfaltz Dec. 1973 124 p refs Prepared in cooperation with Harvard Univ., Cambridge, Mass.

(Contract N00014-73-C-0109)

(AD-A020374; RR-1) Avail: NTIS CSCL 08/6

This project attempts to combine pertinent portions of geographic theory and modern computer science and implement them in a system for geographic data storage and processing.

N76-29799# RAND Corp., Santa Monica, Calif.

A MODEL FOR THE THERMODYNAMIC GROWTH OF SEA ICE IN NUMERICAL INVESTIGATIONS OF CLIMATE

A. J. Semtner, Jr. 7 May 1975 39 p refs

(AD-A020145; P-5432) Avail: NTIS CSCL 08/12

A model is presented whereby the thickness and extent of sea ice may be freely predicted in climate simulations. A basic one-dimensional diffusion process is taken to act in the ice, with modifications due to penetration of solar radiation, melting

of internal brine pockets, and accumulation of an insulating snow cover. This formulation is similar to that of a previous study by Maykut and Untersteiner, but the introduction of a streamlined numerical method makes the model more suitable for use at each grid point of a coupled atmosphere-ocean model. In spite of its simplicity, the ice model accurately reproduces the results of Maykut and Untersteiner for a wide variety of environmental conditions. In 25 paired experiments, annual average equilibrium thicknesses of ice agree within 8 cm for half of the cases and within 20 cm for 80% of the cases. The new model has fewer computational requirements than one layer of ocean in the polar regions, and it can be further simplified if additional savings of computer time are desired. GRA

N76-29800# Polar Research Lab., Inc., Santa Barbara, Calif.
ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS AREA. TECHNICAL REPORT 1: THE SYNRAMS ICE STATION Interim Report
S. P. Burke and B. M. Buck 1 Jan. 1976 10 p refs Repr. from IEEE Ocean, vol. 75, 1975 p 413-417
(Contract N00014-74-c-0065; NR Proj. 307-355)
(AD-A021138; PRL-TR-4) Avail: NTIS CSCL 08/10

A low power, unattended, ice station for collecting data has been developed to collect synoptic environmental data in polar regions for a period of two years. An array of 10 of these ice stations was installed 250-550 nautical miles north of the Alaskan coast during the spring of 1975. In each station, 24 hours worth of the most recent data, made up of eight 32-bit words, are retained in memory for burst transmission to the RAMS (Random Access Measurement System) receiver in the polar orbiting NIMBUS-F satellite. Surface platform location to a CPE of about 5 KM is obtained through Doppler measurement of the transmitted signal. GRA

N76-29801# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Gravity Library Branch.
HOLDINGS, STORAGE AND RETRIEVAL OF DOD GRAVITY LIBRARY DATA
Larry L. Dotson and Edward B. Reinholtz Sep. 1975 42 p refs
(AD-A020426; DMAAC/RP-75-003) Avail: NTIS CSCL 08/5

The Department of Defense (DOD) Gravity Library, maintained by the Defense Mapping Agency Aerospace Center, has grown from a small card storage file to a massive data file contained on magnetic tapes. In the growth process, the library has progressed from the use of a various assortment of card processing equipment to the use of a UNIVAC 1108 computer system. The tremendous increase in holdings and requirements necessitated the establishing of standard formats for all gravity and related data. The receipt of data in various forms and the reduction of this data to a common form made it necessary to develop improved processing techniques for inputting new data. Voluminous retrieval and maintenance of automated data required improved techniques when addressing inquiries to such large files. This report is intended to explain the holdings, system of storage, maintenance of files and retrieval of data. GRA

N76-29802# Naval Research Lab., Washington, D.C. Atmospheric Physics Branch.
MEASUREMENTS OF STRATOSPHERIC WATER VAPOR FROM THE NASA C141 AIRCRAFT Final Report, 1974 - 1975
H. J. Mastenbrook 17 Feb. 1976 18 p refs
(NRL Proj. A03-09)
(AD-A021964; NRL-7960) Avail: NTIS CSCL 04/1

A frost-point hygrometer installed on the NASA C141 Observatory has been used to measure water vapor in the low stratosphere in a 15-degree latitude band over western United States and the eastern Pacific during the winter of 1974-1975. Measurements at 12.5 km in December 1974 revealed regions of below-normal concentration when compared with a 10-year data period beginning in 1964. Measurements in March 1975 show a further drying of the low stratosphere, with a mixing ratio of water vapor to air mass of less than 2.0 ppm. The decrease was observed over a broad latitude band during several flights and appears representative of the midlatitudes generally. Measurements over flight paths which were above the tropopause transition layer showed substantial uniformity over long distances. Typical variability in March was 0.5 ppm about a value of 1.9 ppm. Author (GRA)

N76-29803# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL PHOTODISSOCIATION AND/OR PHOTODETACHMENT OF ATMOSPHERIC NEGATIVE IONS: INITIAL RESULTS ON O2(-) AND CO3(-) Final Report
John A. Vanderhoff and Richard A. Beyer Feb. 1976 25 p refs
(DA Proj. 1T1-61102-B-53A; DNA Proj. NWED-QAXHD010)
(AD-A021935; BRL-MR-2594) Avail: NTIS CSCL 07/5

A drift tube mass spectrometer apparatus with a laser photon source has been constructed to measure photodissociation and/or photodetachment cross sections of atmospheric negative ions. Values for the cross sections of the negative ions of molecular oxygen and carbon trioxide are in good agreement with published results. Most of the data obtained for the discrete energies available to the Kr ion laser represent new results. These results reinforce the existing evidence of substantial structure in the spectrum of the negative carbon trioxide ion photodestruction cross section. GRA

N76-29804# Naval Electronics Lab. Center, San Diego, Calif.
THE EVOLUTION OF THE CLEAR AIR CONVECTIVE LAYER REVEALED BY SURFACE-BASED REMOTE SENSORS Technical Report, Sep. 1973 - Oct. 1975
V. R. Noonkester 5 Dec. 1975 35 p refs
(AD-A021585; NELC-TR-1971) Avail: NTIS CSCL 04/1

Simultaneous observations of the surface-based convection region by two microwave radars and an acoustic echosounder reveal new features of the daytime growth and decay of the convective layer. GRA

N76-29805# Texas Univ. at Dallas, Richardson. Inst. for Geosciences.
ANALYSIS OF DISPERSED SURFACE WAVES FROM NORSAR LONG PERIOD SITES Final Report, 2 Jul. 1973 - 30 Sep. 1975
M. Landisman and Douglas C. Nyman 30 Sep. 1975 15 p refs
(Contract F19628-73-C-0285; ARPA Order 1795)
(AD-A021531; AFCRL-TR-75-0590) Avail: NTIS CSCL 08/11

The bandwidth available for study of NORSAR long period data has been significantly extended, to periods well beyond 200 seconds, even though the recording system is sharply peaked near 20 seconds, through the use of frequency domain compensation for instrumental magnification and phase shift. Inhomogeneities in the lithosphere, especially those in portions of the Oslo Graben near the NORSAR site, affect the propagation of surface waves in this region at least as much as they disturb the progressive wave fields of compressional arrivals. Scale sizes of these lithospheric inclusions ranging to over one hundred kilometers, according to body wave estimates, are thus sufficient to account for lateral refraction and reflection, scattering, non-least-time, and off-great-circle arrivals at remarkably long periods. Two dimensional frequency wave number (f-k) analysis of raw dispersion data reveal azimuthal perturbations of more than twenty degrees, even at periods greater than one hundred seconds. Such f-k analyses of raw dispersion data yield all but useless phase velocities for the array site. GRA

N76-29806# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
ELECTRICAL CHARACTERISTICS OF DRY ROCK-FORMING MINERALS Annual Report, 1 Jun. 1973 - 15 Jun. 1975
R. M. Housley, F. J. Morin, and J. R. Oliver 15 Aug. 1975 27 p refs
(Contract N00014-73-C-0463)
(AD-A021477; SC 557.16AR) Avail: NTIS CSCL 08/7

New dc conductivity versus temperature data on sample of olivine, pyroxene, and feldspar in an atmosphere controlled by the quartz-fayalite-magnetite buffer are presented. Ac data on one of the olivine samples are used to show directly that radio frequency sounding experiments in a lithospheric waveguide bounded above by conducting wet rocks and below by conducting hot rocks are a plausible possibility. GRA

N76-29807# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
QUANTITATIVE GLOBAL MODEL OF IONOSPHERIC ELECTRON DENSITY Annual Report
W. P. Olson and K. A. Pfitzer 26 Feb. 1976 19 p
(Contract N00014-75-C-0821; NR Proj. 323-032)
(AD-A021333) Avail: NTIS CSCL 04/1

In this report contract work to date on the development of a quantitative ionospheric model is discussed. It is the purpose of the contract effort to develop a quantitative global model of total ionospheric electron density as a function of position and long term time variations (e.g., semiannual and solar cycle variations). GRA

N76-29808# Colorado Univ., Boulder.
INVESTIGATIONS OF TECTONIC STRESS, APPLIED RELAXATION-SOURCE THEORY TO EARTHQUAKE-EXPLOSION DISCRIMINATION Final Report 1 Nov. 1973 - 31 Aug. 1975
Charles B. Archambeau 15 Aug. 1975 184 p refs
(Contract F19628-74-C-0087; ARPA Order 1795)
(AD-A021744; AFCRL-TR-75-0467) Avail: NTIS CSCL 08/11

Results relating to the analytical modeling of earthquakes by relaxation-source theory models are summarized. Applications to explosion-earthquake discrimination and earthquake source parameter estimation, particularly tectonic stress determinations, are discussed in detail. The theoretical work summarized includes: generalized representation theorems, energy considerations, equivalence theory, radiation field solutions for relaxation models of earthquakes, computer based earthquake field simulation, predictions of m sub b - M sub s relations for earthquakes and explosions, and comparisons of relaxation source theory results with results from numerical models of earthquakes. Further, the theoretical basis for m sub b - M sub s discrimination and discrimination using spectral magnitude parameters is discussed in detail. Comparative studies undertaken, involving observed data for earthquakes, include comparisons of relaxation theory spectra to observations of earthquake spectra in the near field distance range with associated inference of source properties, and modeling of the static field using numerical dislocation and relaxation models in order to infer failure conditions and prestress fields. GRA

N76-29809# National Swedish Inst. for Building Research, Stockholm.
PROCEEDINGS OF THE EUROPEAN SYMPOSIUM ON PENETRATION TESTING (ESOPT). VOLUME 2, PART 2: PAPERS
Jan. 1975 409 p refs Conf. held at Stockholm, 5-7 Jun. 1974; sponsored by Swedish Geotech. Soc.
(PB-251358/8; ISBN-91-540-2428-5-Vol-2-Pt-2) Avail: NTIS HC $11.00 CSCL 08M

The European Symposium on Penetration Testing is documented in two Volumes. Vol. 1 includes national State-of-the Art Reports from twenty six countries. Vol. 2 is published in two parts. Part 1 contains general reports, discussions and a documentation of the symposium activities. This part, Vol. 2, includes 65 papers which have been, after invitation to the national societies, submitted by specialists in the field of penetration testing. GRA

N76-29810# National Swedish Inst. for Building Research, Stockholm.
PROCEEDINGS OF THE EUROPEAN SYMPOSIUM ON PENETRATION TESTING (ESOPT). VOLUME 2, PART 1: GENERAL REPORTS, DISCUSSIONS AND OTHER ACTIVITIES
Jan. 1975 259 p refs Conf. held at Stockholm, 5-7 Jun. 1974; sponsored by Swedish Geotech. Soc.
(PB-251357/0; ISBN-91-540-2426-9-Vol-2-Pt-1) Avail: NTIS HC $9.00 CSCL 08M

The written contributions to the symposium and other symposium activities are documented in Vol. 2 of the proceedings which consists of two parts. Part 1 contains, in addition to the opening and closing addresses: General reports with summaries of the national State-of-the-Art Reports; Conclusions from the group discussions presented at the panel discussion; written contributions to the group discussions and the general discussion. They are arranged with respect to the five discussion groups. The Appendix includes a description of the field demonstration site and a documentation of the exhibition and of the field demonstration. GRA

N76-29811# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
DISTANCE-AMPLITUDE RELATIONSHIPS FOR LONG-PERIOD P, S, AND LR FROM MEASUREMENTS ON RECORDINGS OF THE LONG-PERIOD EXPERIMENTAL STATIONS
D. H. VonSeggern 24 Sep. 1975 26 p refs
(Contract F08606-76-C-0004; ARPA Order 1620)
(AD-A021506; SDAC-TR-75-14) Avail: NTIS CSCL 08/11

Measurements on long-period P, S, and LR phases were extracted from an eight-month data base for nine stations of the Long Period Experimental network. Amplitude-distance curves were plotted for P and S from shallow-focus events; these curves generally agreed with the commonly-used Gutenberg-Richter B factors. The amplitude-distance curve for LR was different in slope than the commonly-used correction curve for M sub S; however, this difference would not be sufficient to affect routine network M sub S estimates by more than roughly .1 magnitude unit. The Q for 20-second LR implied by this new data is roughly 700, in contrast to the 300 implied by the accepted amplitude-distance curve. GRA

N76-29812# Missouri Univ., Columbia.
DISEASE INFORMATION SYSTEM. GROUND TEMPERATURE DERIVED FROM OTHER GEOPHYSICAL OBSERVATIONS Interim Report
J. A. Spratt, Francis R. Watson, and Donald A. B. Lindberg Jan. 1976 74 p refs
(Contract DAMD17-74-C-4122)
(AD-A021524; MOU-IS-PR-8) Avail: NTIS CSCL 06/5

This paper describes two mathematical methods for predicting temperatures over a relatively large area when only a small amount of actual data is known. Known temperatures from a few locations are compared with the physical characteristics of these locations from data gathered from standard topographic maps. The topographic data for the unknown sites is then recorded and a prediction is made of these sites using the data and temperatures from the known sites. The first method is a statistical regression analysis which can only be done with the aid of a large computer. The second method is a simplified version of the first which can be implemented on a smaller machine or by hand if necessary. GRA

N76-29813# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
SPECTRAL PROPERTIES AND SOURCE AREAS OF STORM MICROSEISMS AT NORSAR
H. Korhonen (Univ. of Oulu, Finland) and S. E. Pirhonen (Univ. of Helsinki, Finland) 3 Feb. 1976 38 p refs
(Contract F08606-76-C-0001; ARPA Order 2551)
(AD-A021450; NORSAR-2-75/76) Avail: NTIS CSCL 17/10

Spectral estimates from eight microseismic storms recorded by long period vertical component seismometers at NORSAR exhibit distinct spectral peaks in the bands 50-85 mHz and 110-195 mHz. A high frequency third peak (180-250 mHz) is also resolvable in some cases. High resolution frequency wave-number analysis of the storm microseisms yield azimuthal estimates which are accordant with meteorological disturbances over both the North Atlantic Ocean and the Norwegian Sea. The early stages of a typical storm development are characterized by a relatively concentrated microseismic source area to the west of NORSAR, whereas later on the source area expands and new sources appear to the NW and to the north of NORSAR. Simultaneously the spectral peaks migrate towards higher frequencies. GRA

N76-29814# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 54 Annual Summary Report for FY 1975
Oct. 1975 20 p refs
(Contract DNA001-75-C-0023; DNA Proj. NWED-QAXDC008)
(AD-A022067) Avail: NTIS CSCL 04/1

Contents: Weapons Phenomenology in the Containment Zone; Reaction Rates Critical to Propagation; Theoretical Studies of Ionizing Mechanisms in the Upper Atmosphere; Determination of Reaction Rates and Ionizing Mechanisms by Use of Natural Disturbances; Atomic and Molecular Physics of IR Emissions; and IR Phenomenology and Optical Code Development. GRA

N76-29815 Advisory Group for Aerospace Research and Development, Paris (France).
OPTICAL PROPAGATION IN THE ATMOSPHERE
May 1976 625 p refs Presented at the Electromagnetic Wave Propagation Panel Symp., Lyngby, Denmark, 27-31 Oct. 1975.
(AGARD-CP-183) Copyright. Avail: NTIS HC $16.25

Atmospheric effects are reported on the propagation of optical systems emphasizing high power lasers and adaptive optical correction procedures. For individual titles, see N76-29816 through N76-29859.

N76-29816 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
OPTICAL MODELLING OF THE ATMOSPHERE
Robert A. McClatchey, John E. A. Selby, and John S. Garing *In* AGARD Opt. Propagation in the Atmosphere May 1976 21 p refs (For availability see N76-29815 20-46)

Optical atmospheric modelling requires both the knowledge of the physical properties of the atmosphere as well as the spectroscopic properties of the gases and particulates of which it is composed. The atmospheric absorption line parameter compilation system is discussed and requirements for such a data compilation are indicated. The line-by-line transmittance calculation technique is described, indicating the capability of this technique for use in laser propagation studies as well as low spectral resolution applications. The LOWTRAN computer model is presented together with an indication of its limitations. Author

N76-29817 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MODELS OF THE ATMOSPHERIC AEROSOLS AND THEIR OPTICAL PROPERTIES
Eric P. Shettle and Robert W. Fenn *In* AGARD Opt. Propagation in the Atmosphere May 1976 16 p refs (For availability see N76-29815 20-46)

Aerosol models have been developed for the boundary layer, the upper troposphere, the stratosphere, and mesosphere. In the boundary layer they describe three different environments: rural, urban and maritime. In the upper troposphere and stratosphere two different models represent spring-summer and fall-winter conditions. In the stratosphere they describe several levels of volcanic dust concentrations and the background conditions. For each model the coefficients for extinction, scattering and absorption, the angular scattering distribution and other optical parameters have been computed for wavelengths between 0.2 and 40 micrometer. The aerosol models are being presented along with a discussion of their experimental basis. The optical properties of these models are being discussed and some examples of their effects on the overall atmospheric transmission properties and atmospheric contrast reduction are presented. Author

N76-29818 Plessey Radar Ltd., Cowes (England).
A COMPARATIVE STUDY OF ATMOSPHERIC TRANSMISSION AT THREE LASER WAVELENGTHS IN RELATION TO THE METEOROLOGICAL PARAMETERS c36
P. J. Wright *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

Experimental and theoretical studies are reported on the atmospheric transmission of laser radiation at 0.63 micrometer, 1.03 micrometer and 10.6 micrometer. A transmissometer continuously measured the attenuation of the three wavelengths simultaneously over a common path length. Results were compared with deduction from the theory of scattering of electromagnetic radiation due to Mie. Author

N76-29819 Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
REMOTE AEROSOL SENSING WITH AN ABSOLUTE CALIBRATED DOUBLE FREQUENCY LIDAR c36
R. Reiter, W. Carnuth, M. Littfass, and N. C. Varshneya (Roorkee Univ.) *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs (For availability see N76-29815 20-46)

A two frequency lidar system, using a Q-switched ruby laser transmitter with frequency doubler and a 52 cm dia. receiving telescope, for remote aerosol sensing up to more than 30 km altitude is described. The system includes electronic data acquisition and processing. Sufficient sensitivity for high altitude stratospheric measurements is provided by ten channel photon counting combined with range gating of the photomultiplier tube, and a mechanical chopper for rejection of the non-coherent ruby fluorescence. The system is now being absolutely calibrated by comparison between lidar backscatter profiles on the one hand, and theoretical backscatter functions calculated from experimental aerosol and aerological data, using Rayleigh and Mie scattering theories, on the other. The experimental data are acquired at mountain stations at 740, 1,800 and 3,000 m altitude by means of five stage impactors and of cable car probes and radiosondes. Examples of tropospheric lidar backscatter profiles, together with aerosol and aerological profiles, as well as stratospheric lidar measurements are presented. Author

N76-29820 Norwegian Defence Research Establishment, Kjeller.
ATMOSPHERIC EFFECTS RELEVANT TO LASER SPECTROSCOPY c36
T. Lund and A. G. Kjelaas *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

A qualitative discussion pointing out some of the sources of error and fluctuations in a long path laser differential absorption system measuring the concentration of atmospheric gaseous pollutants, is given. Except for single gas detectors using narrow optical frequency ranges, the unpredictable or unknown spread in the dispersive properties of the extinction caused by continuum absorption and scatter, is of major concern. In addition, the limitations of fast cross correlation of signals to compensate for turbulence induced fluctuation are discussed. Author

N76-29821 California Univ., Los Angeles.
THE FLUID MECHANICS AND COMPUTER MODELING OF ATMOSPHERIC TURBULENCE CAUSING OPTICAL PROPAGATION FLUCTUATIONS
William C. Meecham *In* AGARD Opt. Propagation in the Atmosphere May 1976 9 p refs (For availability see N76-29815 20-46)

Optical refractive index fluctuation are examined from the viewpoint of what is known by fluid dynamicists about atmospheric turbulence effects. Various field quantities (temperature, velocity and pressure) are written in terms of their averages and their fluctuations from those averages. The variations of the index of refraction with the fluid variables are discussed. The cross correlations of fluid velocity, of temperature, and of velocity with temperature are presented. A new, modified discussion of the Kolmogoroff cascade theory of turbulence is presented and its consequences analyzed for their bearing upon correlation functions and energy spectra. Using this fluid mechanical information, the modeling of propagation fluctuation problems is reported using computer generated realizations of index variations, with given statistical properties. Author

N76-29822* Texas A&M Univ., College Station. Dept. of Physics.
CALCULATIONS OF POLARIZATION AND RADIANCE IN THE ATMOSPHERE
Gilbert N. Plass *In* AGARD Opt. Propagation in the Atmosphere May 1976 20 p refs (For availability see N76-29815 20-46)
(Grant NGR-44-001-117)
CSCL 04A

Two different methods for the solution of radiative transfer problems, matrix operator and Monte Carlo, are discussed. As an example of the use of the method, results are given for the radiance and polarization of the radiation scattered from haze layers as well as from models of the real atmosphere. The variation of the radiance, polarization, and ellipticity with the aerosol amount in the real atmosphere model is presented. The Monte Carlo method is applied to the problem of calculation of the radiance and polarization of the photons in the atmosphere when there

is an ocean as the lower surface. It is found that the turbidity of the ocean can be deduced from the upwelling radiance measured at some height in the atmosphere. The downwelling radiation just beneath the ocean surface is elliptically polarized at those angles where it is derived from the total internal reflection of the upwelling radiation at the ocean surface. Author

N76-29823 Utah Univ., Salt Lake City. Dept. of Meteorology.

RADIATIVE TRANSFER IN CLOUDY ATMOSPHERES

K. N. Liou *In* AGARD Opt. Propagation in the Atmosphere May 1976 12 p refs (For availability see N76-29815 20-46) (Contract F19628-75-C-0107; Grant NSF DES-75-05216)

Band-by-band calculations have been carried out to evaluate the reflection, absorption and transmission of solar radiation by cloud layers and model cloudy atmospheres in the entire solar spectrum. The radiation transfer program is based on the discrete ordinate method with applications to inhomogeneous atmospheres. The gaseous absorption in scattering atmospheres is taken into account by means of exponential fits to the total band absorption based on laboratory measurements. Thick clouds such as nimbostratus and cumulonimbus reflect 80-90% and absorb 10-20% of the solar radiation incident upon them. The reflection and absorption of a fairweather cumulus with a thickness of 0.45 km are about 68-85% and 4-9% respectively. Comparisons with aircraft observations reveal that within the uncertainties of the thickness and cloud particle characteristics theoretical computations yield higher reflection and lower absorption values for most of the water clouds. These comparisons indicate that clouds in the atmosphere are likely to consist of absorbing particles. Author

N76-29824* Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.

MULTIPLE SCATTERING IN PLANETARY ATMOSPHERES c91

William M. Irvine *In* AGARD Opt. Propagation in the Atmosphere May 1976 11 p refs (For availability see N76-29815 20-46) (Grant NGL-22-010-023)

CSCL 03B

Certain simple procedures for solving radiative transfer problems in planetary atmospheres are reviewed: the similarity relations relating isotropic to anisotropic scattering, asymptotic results relating known solutions for semi-infinite layers to desired solutions for optical depths, and expansions relating known solutions for conservative scattering to desired solutions for the nearly conservative case. The complications introduced by atmospheric inhomogeneity, surface reflection, and spectral features are also discussed. Author

N76-29825 Universite des Sciences et Techniques de Lille (France).

METHODS FOR SOLVING THE EQUATION OF RADIATIVE TRANSFER THROUGH FINITE THICKNESS LAYERS

J. Lenoble *In* AGARD Opt. Propagation in the Atmosphere May 1976 9 p refs In FRENCH; ENGLISH summary (For availability see N76-29815 20-46)

After recalling the general problem of radiative transfer, the methods of solution for a plane parallel horizontally homogeneous atmosphere are briefly reviewed and a few numerical comparisons are shown. Then the more difficult problems of horizontal inhomogeneities and of sphericity are considered. Author

N76-29826* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

REMOTE PROBING OF ATMOSPHERIC PARTICULATES FROM RADIATION EXTINCTION EXPERIMENTS: A REVIEW OF METHODS

Alain L. Fymat *In* AGARD Opt. Propagation in the Atmosphere May 1976 30 p refs (For availability see N76-29815 20-46) (Contract NAS7-100)

CSCL 04A

The existing methodology for reconstructing the particle size distribution and inferring the refractive index of absorbing and scattering atmospheric particulates is critically reviewed. Emphasis is placed on method capabilities and shortcomings and, wherever possible, on achievable accuracy. The nature of the associated remote probing problem is analyzed with regard to the effects of the particulates on EM wave propagation in the atmosphere. The parameterization of size distribution is studied within the unifying framework of Pearson's distribution curves. The inversions of extinction measurements and their ratios are considered separately, and the potentialities of each type of measurement are identified. Work lacking in each of the methods reviewed is indicated. A method of determining both the effective complex refractive index and size distribution model parameters from the same data is also presented. Lastly, determination from extinction ratio data of the complex refractive index independent of size distribution is discussed and error analyzed. Author

N76-29827 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

THEORETICAL STUDIES OF THE TRANSFER OF SOLAR RADIATION IN THE ATMOSPHERE

M. J. Kerschgens, E. Raschke, and U. Reuter *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

The transfer of solar radiation in one dimensional model atmospheres has been computed for the wavelength range from 0.2 to 3.58 micrometer with an iterative solution of the radiative transfer equation. Absorption by O3, H2O, CO2, O2 and aerosols has been taken into account. The transmission in near infrared bands of CO2 and H2O is approximated by exponential series derived from spectral measurements. Various vertical distributions of H2O and aerosols are considered and also two different boundaries are used: a rough ocean surface and a bright sandy desert. It is shown, for instance that as a result of the higher albedo of the sand surface, the absorption increases by 5 to 7% depending on the solar height. Aerosol layers in the lower troposphere are much more effective respective to absorption. They may alter by almost 40% the radiative heating. Author

N76-29828 Physics Lab. RVO-TNO, The Hague (Netherlands).

THE MEASUREMENT PROGRAMME OPAQUE OF AC/243 (PANEL IV/RSG.8) ON SKY AND TERRAIN RADIATION

T. Baker *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p (For availability see N76-29815 20-46)

A measurement program on optical parameters of the atmosphere and environmental characteristics is reported. The aim of the project is to develop a data base of those parameters of the atmosphere and the environment that affect the performance of optical and electro-optical sensors during military operations. From the correlation with the meteorological data, the possibilities of forecasting the performance of the above mentioned sensors will be studied. The program consists of a minimum required set of parameters, to be measured at fixed times (every hour on the hour, local mean time) on all sites during a period of at least two years. At some of the sites a program of recommended additional measurements will be carried out during limited time periods. Author

N76-29829 Forschungsinstitut Fuer Optik, Tuebingen (West Germany).

EXPERIMENTAL AND COMPUTATIONAL COMPARISON OF DIFFERENT METHODS FOR DETERMINATION OF VISUAL RANGE

W. Buechtemann, H. Hipp, W. Jessen, and R. Neuwirth *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs (For availability see N76-29815 20-46)

Three visibility meters of different type have been run simultaneously over several weeks. At the same time aerosol spectra were collected using an optical counter. The visibility readings were compared under several meteorological conditions and a Junge distribution or a modified gamma - distribution has been fitted to the experimental aerosol size distribution. Using Mie's theory and the data recorded, the readings of the instruments have been compared with the computed total extinction and the values computed based on actual instrument parameters, i.e. especially the angular response in the case of two scattering type instruments. A good agreement between the observational visibilities is obtained, except under particular meteorological conditions. Computed visibilities give a generally correct prediction of the measured extinction. Author

N76-29830 Universite des Sciences et Techniques de Lille (France).

RADIATIVE TRANSFER IN A SCATTERING ABSORBING MEDIUM

Y. Fouquart and J. C. Buriez *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs In FRENCH; ENGLISH summary (For availability see N76-29815 20-46)

The computation of radiative transfer in a scattering and absorbing atmosphere is particularly complicated because absorption by gases and scattering by particles occur simultaneously. The most suitable method is to use the distribution of phonon optical path to disjoin absorption and scattering. The phonon optical path distribution is computed for a given scattering medium by means of Pade approximation. The solution of the transfer equation is found by any approximate or accurate method and absorption by gases is computed by means of band models. The method is presented and applied to calculate the intensity reflected by an inhomogeneous cloud. Author

N76-29831 Clarkson Coll. of Technology, Potsdam, N.Y.

FLUORESCENT AND RAMAN SCATTERING IN PARTICLES **c72**

M. Kerker, P. J. McNulty, and H. Chew *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

When inelastically scattering molecules are distributed within a small particle, they respond to the local nonuniform electromagnetic field within the particle. The outgoing inelastic field is obtained by matching at the boundary the dipole field of the emitting molecules plus an internal field with the outgoing field. In this way, it is possible to express the inelastic radiances in terms of the geometry and optical properties of the particle, of the distribution of inelastically scattering molecules within the particle, and of the molecular polarizability, for both coherent and incoherent scattering. Author

N76-29832 Aerospace Corp., Los Angeles, Calif. Electronics Research Lab.

PHYSICAL MODEL FOR STRONG OPTICAL WAVE FLUCTUATIONS IN THE ATMOSPHERE

H. T. Yura *In* AGARD Opt. Propagation in the Atmosphere May 1976 24 p refs (For availability see N76-29815 20-46)

Elementary physical arguments are used to deduce the qualitative functional dependence of amplitude and phase statistics on the optical wave number, propagation distance and the parameters that describe the turbulent medium. An attempt is made to delineate the underlying physical mechanisms which produce such fluctuations and as such the derivations presented here complement the more rigorous analysis presented elsewhere. Although the discussion is limited to the basic plane- and spherical-wave amplitude and phase statistics for constant turbulence conditions, the extension to the case of inhomogeneous turbulence conditions is straightforward. Finally, the propagation of beam waves in a turbulent medium is determined from a knowledge of the propagation characteristics of spherical waves via the extended Huygens-Fresnel principle. As a result, the qualitative dependence of the characteristics of beam waves can be obtained directly from the spherical wave coherence length discussed above. Author

N76-29833 Defence Research Establishment Valcartier (Quebec).

LOG-NORMAL PROBABILITY DISTRIBUTION OF STRONG IRRADIANCE FLUCTUATIONS: AN ASYMPTOTIC ANALYSIS **c74**

Luc R. Bissonnette *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

The asymptotic solutions for the first- and second-order statistical moments of the amplitude of a plane optical wave propagating in a turbulent atmosphere are derived from Maxwell's equations. These solutions show that the irradiance variance diverges to infinity if the irradiance probability distribution is everywhere log-normal. Therefore, the widely used log-normal hypothesis is incompatible with the observation of the saturation of the irradiance variance. Using the same asymptotic solutions, it is shown that the irradiance variance tends to unity if, alternately, the wave amplitude has a normal distribution in the saturation region. The latter result is much more consistent with the measured saturation levels. Finally, direct probability measurements in a simulated atmosphere tend to confirm that the actual distribution is close to normal at saturation distances. Author

N76-29834 Oregon Graduate Center for Study and Research, Beaverton.

TURBULENCE EFFECTS ON TARGET ILLUMINATION BY LASER TRANSMITTER: UNIFIED ANALYSIS AND EXPERIMENTAL VERIFICATION **c36**

J. Richard Kerr *In* AGARD Opt. Propagation in the Atmosphere May 1976 27 p refs Sponsored in part by DARPA and AFSC (For availability see N76-29815 20-46)

A phenomenological and analytical description is given of atmospheric turbulence effects on laser beam waves, including the improved target irradiance characteristics resulting from cancellation of turbulence induced beam wander through reciprocity tracking. The mechanisms related to the mean irradiance include diffraction, wander, and wavefront distortion (beamspread), while irradiance fading is caused by wander, first order scintillation, and coherent fading. The phenomenological description unifies the often fragmentary and inconsistent treatment of beam wave phenomena found in the literature, and is sufficiently accurate for engineering purposes. It was shown that wander cancellation and control of the transmitter beam diameter results in substantial improvements in target illumination. The analyses are compared with experimental data for the detailed statistical and spectral characteristics of on-axis target irradiance. Author

N76-29835 Forschungsinstitut Fuer Optik, Tuebingen (West Germany).

PROPAGATION OF FOCUSED LASER BEAMS IN THE TURBULENT ATMOSPHERE **c36**

H. Raidt *In* AGARD Opt. Propagation in the Atmosphere May 1976 12 p refs (For availability see N76-29815 20-46)

Experimental results from investigations of instantaneous intensity distributions in focused laser beams at 0.63 micrometer and 10.6 micrometer at distances of approximately 1.3 km, 5 km and 8.6 km are presented and discussed. At 0.63 micrometer the beam pattern is broken up into several diffraction scale spots because focusing is saturated, except for weak turbulence and short propagation distance. At 10.6 micrometer the beam pattern is almost uniform, as long as the beam dimensions are smaller than the correlation length of the amplitude. Author

N76-29836 Pacific Sierra Research Corp., Santa Monica, Calif.

PROPAGATION OF FOCUSED TRUNCATED LASER BEAMS IN THE ATMOSPHERE **c36**

R. F. Lutomirski *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs (For availability see N76-29815 20-46)

A formula is derived for the mean intensity distribution from a finite beam in terms of the complex disturbance in the aperture and the mutual coherence function (MCF) for a spherical wave in the medium. The formula is used to examine the effects of turbulence on the long term average intensity produced by a focused, truncated Gaussian aperture distribution. It is shown that while the vacuum focal point intensity will increase as the degree of truncation decreases for a given laser output power, the effect of turbulence limits this increase, and that the turbulence can virtually eliminate the vacuum advantage of visible over infrared wavelengths in focusing the beam at practical ranges. Transverse beam patterns and the on-axis intensity are shown for CO2 wavelength, and a criterion is established for the condition under which the turbulence prevents effective focusing. Author

N76-29837 Queen Elizabeth Coll., London (England). Dept. of Physics.

MEASUREMENTS OF THE ATMOSPHERIC TRANSFER FUNCTION

J. C. Dainty and R. J. Scaddan (Imperial Coll. of Sci. and Technol.) *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs (For availability see N76-29815 20-46)

A wavefront folding interferometer has been constructed with which the long time averaged modulation transfer function, MTF, of the atmosphere can be measured. The instrument was used to determine the MTF over 10 nights in June 1974 at Mauna Kea Observatory, Hawaii, using bright stars as sources. The form of the MTF at separations of a few centimeters in the pupil

agreed with that predicted on the basis of a Kolmogorov spectrum of turbulence, but there was a departure at larger separations. The MTFs were highly variable both from hour-to-hour and night-to-night; the wavefront correlation region varying from approximately 4 to 20 cm. Increasing the zenith angle generally decreased the correlation region, but no exact relationship was observed. Author

N76-29838 Rome Univ. (Italy).
INTENSITY CORRELATION OF RADIATION SCATTERED ALONG THE PATH OF A LASER BEAM PROPAGATING IN THE ATMOSPHERE **c36**
M. Bertolotti, M. Carnevale (Fondazione Ugo Bordoni, Rome, Italy), B. Crosignani (Fondazione Ugo Bordoni, Rome, Italy), B. Daino (Fondazione Ugo Bordoni, Rome, Italy), and P. DiPorto (Fondazione Ugo Bordoni, Rome, Italy) *In* AGARD Opt. Propagation in the Atmosphere May 1976 9 p refs (For availability see N76-29815 20-46)

Correlation properties of the electromagnetic field scattered away from the direction of propagation of a laser beam are studied. The correlation could be used for whenever a direct measurement of the scattered intensity is difficult due to background radiation. Correlation measurements are also connected with the scale of atmospheric turbulence. Author

N76-29839 Rome Univ. (Italy).
MEASUREMENT OF ATMOSPHERIC ATTENUATION AT 6328 A **c36**
M. Bertolotti, M. Carnevale (Fondazione Ugo Bordoni, Rome, Italy), B. Daino (Fondazione Ugo Bordoni, Rome, Italy), M. Galeotti (Fondazione Ugo Bordoni, Rome, Italy), and D. Sette *In* AGARD Opt. Propagation in the Atmosphere May 1976 7 p (For availability see N76-29815 20-46)

The influence of the free atmosphere on the propagation properties of laser beams has been studied for a communication link through the determination of atmospheric attenuation statistics, and for the effects of turbulence and atmospheric conditions. Author

N76-29840 Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche.
MEASUREMENTS OF ANGLE OF ARRIVAL FLUCTUATIONS OF A LASER BEAM DUE TO TURBULENCE **c36**
Anna Consortini *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

The angles of arrival fluctuations were measured for a diverging laser beam after propagation through turbulence, firstly through a thin layer of artificial turbulence, then through the atmosphere at near ground levels. In the first case the influence of the position of the layer is put in evidence. In the case of the atmosphere approximate values of the inner scale of turbulence and the structure constant are derived by a comparison with the theory of Tatarski. Author

N76-29841 Plessey Radar Ltd., Cowes (England).
A MULTIPLE SCATTERING CORRECTION FOR LIDAR SYSTEM **c36**
J. V. Winstanley and C. Wigmore *In* AGARD Opt. Propagation in the Atmosphere May 1976 13 p refs (For availability see N76-29815 20-46)

Multiple scattering phenomena are treated as effective beam broadening mechanisms. At any given range the amount of beam overlap was greater in the cases of fog and smoke than in clear air. In addition, the amount of beam overlap increased as the optical density increased. A beam broadening correction factor was therefore defined as the ratio of beam overlap in poor visibility conditions to that in clear air, measured at the same range. Experimental measurements were made of the beam broadening factors, using a GaAc lidar system. The results obtained were expressed as a graph of correction factor versus extinction coefficient for each range element, and were in fair agreement with the theoretical models of Chu and Hogg and Kunkel. Author

N76-29842 Societe Anonyme de Telecommunications, Paris (France).
MEASUREMENT OF ATMOSPHERIC ABSORPTION BY UTILIZATION OF AN INFRARED SOLAR RADIATION RECEIVER [MESURES DE L'ABSORPTION ATMOSPHERIQUE PAR UTILISATION D'UN RADIOMETRE HETERODYNE INFRA-ROUGE SOLAIRE]
B. Christophe and M. Camus *In* AGARD Opt. Propagation in the Atmosphere May 1976 13 p refs In FRENCH (For availability see N76-29815 20-46)

The physical principles underlying the coherent and incoherent heterodyne detection technique in the middle infrared region were described. The application of this technique to the measurement of atmospheric transparency was illustrated, including presentation of the first results so far available. Transl. by Y.J.A.

N76-29843 Naval Research Lab., Washington, D.C.
PROPAGATION OF HIGH POWER LASER BEAMS THROUGH THE ATMOSPHERE: AN OVERVIEW **c36**
John N. Hayes *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs (For availability see N76-29815 20-46)

The major categories of the thermal blooming phenomena encountered in the propagation of high power laser beams in the open atmosphere are developed. The basic physical ideas behind each type of blooming phenomenon are discussed; experimental data and theoretical formulation are briefly presented that show the present state of knowledge. Author

N76-29844 Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN OVERVIEW OF THE LIMITATIONS ON THE TRANSMISSION OF HIGH ENERGY LASER BEAMS THROUGH THE ATMOSPHERE BY NONLINEAR EFFECTS **c36**
S. Edelberg *In* AGARD Opt. Propagation in the Atmosphere May 1976 15 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

The important nonlinear effects which limit high energy laser propagation through the atmosphere are reviewed. The two most important effects are thermal blooming (or thermal defocussing) and air breakdown within the beam. A third, less important effect is stimulated raman scattering. The possibility of transmitting laser beams through fogs, clouds or haze by boring holes through these atmospheric media with the laser beam is also reviewed. The laser's waveform is considered to be a train of pulses. It is shown that the waveform design and other important parameters such as range to the focal plane, aperture and focal spot size, pulse intensity, etc., can be chosen to avoid the thermal blooming of individual pulses and air breakdown. The limit on beam propagation is then caused by thermal blooming due to the cumulative heating by the pulses in the train. An added set of parameters then controls this multipulse blooming including beam slew rate, cross wind velocity, and interpulse spacing. Parametric tradeoffs required to satisfactorily control thermal blooming and quantitative results for several parametric choices are summarized. Author

N76-29845 Naval Research Lab., Washington, D.C.
NUMERICAL METHODS IN HIGH POWER LASER PROPAGATION **c36**
Peter B. Ulrich *In* AGARD Opt. Propagation in the Atmosphere May 1976 19 p refs (For availability see N76-29815 20-46)

Numerical solutions to the complex nonlinear problems of the interaction of high energy lasers with the atmosphere have played an important role in the understanding and development of this important and interesting field. Summarized are the relevant partial differential equations that apply, the kinds of numerical algorithms employed in their solution and representative results of a variety of cases of interest. Comparison with experiment is made wherever possible. Other effects which impact the thermal blooming phenomena are also addressed. Author

N76-29846 Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE LIMITATIONS IMPOSED BY ATMOSPHERIC BREAKDOWN ON THE PROPAGATION OF HIGH POWER LASER BEAMS **c36**
D. E. Lencioni *In* AGARD Opt. Propagation in the Atmosphere May 1976 12 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

The results of a series of experiments on laser induced air breakdown at 10.6 and 1.06 micrometers are reported. Threshold intensities for breakdown were determined for clean air, aerosols, and single particles. The clean air threshold was found to be in good agreement with microwave breakdown theory. The presence

of aerosol particles was found to lower the threshold by an amount which depended mainly on particle size and laser pulse length. Only a slight material dependence was found with the one exception of water particles which had the least effect on threshold. The particle induced thresholds were found to scale as wavelength to the minus two power for 100 nsec pulse lengths. The dynamics of the particle initiated thresholds were studied. For intensities slightly above threshold the plasma grew within the beam as an axisymmetric volume surrounding the particle. At higher intensities the plasma formed as a highly absorbing thin disk which grew radially and propagated back towards the laser. Author

N76-29847 Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL DETERMINATION OF SINGLE AND MULTIPLE PULSE PROPAGATION **c36**
R. W. ONeil, H. Kleiman, and H. R. Zwicker *In* AGARD Opt. Propagation in the Atmosphere May 1976 13 p refs Sponsored by ARPA (For availability see N76-29815 20-46)

Thermal blooming of focused single and multiple pulse lasers is considered. Experimental procedures are described to characterize the reduction in far field irradiance observed for pulses whose duration is comparable to and shorter than the acoustic transit time across a focal radius. Experimental measurements of short pulse blooming are compared with a scalar wave theoretical computer model embodying the medium hydrodynamics. Agreement with the short pulse theory is generally good. An experiment was designed to test the quantitative predictive capability of a steady state multiple pulse computer code. Blooming of a multiple pulse beam was measured as a function of absorbed energy and spatial overlap of successive pulses. Agreement between the actual measurements and those predicted by theory was very good. Author

N76-29848 Defense Advanced Research Projects Agency, Arlington, Va.
COMPENSATED IMAGING **c74**
James W. Justice and Raymond P. Urtz, Jr. (RADC, Griffiss AFB, N. Y.) *In* AGARD Opt. Propagation in the Atmosphere May 1976 17 p refs (For availability see N76-29815 20-46)

The presence of the atmosphere degrades the imaging performance of large telescopes. Optical phase distortion imposed by atmospheric turbulence causes a loss in resolution capability of from 10 to 30 times a system's theoretical performance. A compensated imaging approach is reported which allows the retrieval of low contrast information by active adaptation of the telescope system to atmospheric conditions. This is accomplished through the use of real time wavefront sensing coupled with fast response deformable optics. In practice, the wavefront entering the telescope is measured to determine its wavefront deformation (optical path length difference across the aperture) and a mirror is then deformed to the conjugate of the deformations, producing a near diffraction limited image on a sensor. Analysis of the wavefront correction capabilities has been completed. Author

N76-29849 Consiglio Nazional delle Ricerche, Bologna (Italy).
DETERMINATION OF SLANT VISUAL RANGE FROM LIDAR SIGNATURES, ANALYSIS OF SIMULATED SIGNATURES **c36**
Mario Gazzi, Vittorio Vicentini, Luca Pantani, Bruno Radicati, Leopoldo Stefanutti, and Christian Werner (DFVLR) *In* AGARD Opt. Propagation in the Atmosphere May 1976 19 p refs (For availability see N76-29815 20-46)

The measurement of the slant visual range by means of lidars involves two main problems: the extraction of the atmospheric extinction coefficient from the lidar signature and the calculation of the slant visual range from the extinction coefficient. These problems were solved for the particular situation of a landing in low visibility conditions. An equation was obtained which allows the computation of the visual range from the extinction coefficient in every hour of the day both for extended and point sources. In order to compare the different methods for the extraction of the extinction coefficient from the lidar signatures some atmospheric situations were simulated on a computer, and the lidar equation was calculated. The simulated signatures were then processed by different methods and the results were collated. A new procedure for the processing of lidar signatures was introduced. Author

N76-29850 California Univ., San Diego.
COMPUTER SIMULATION OF ATMOSPHERIC TURBULENCE AND COMPENSATED IMAGING SYSTEMS **c74**
B. L. McGlamery *In* AGARD Opt. Propagation in the Atmosphere May 1976 17 p refs (For availability see N76-29815 20-46)

The earth's turbulent atmosphere severely limits the resolution of conventional ground based telescopes. Methods of reducing this limitation for ground based telescopes include post detection processing in which the blurred recorded image is processed to extract information not discernable to the human visual system, and pre-detection compensation in which the wave front deformations are dynamically corrected in the optical system before the image is recorded. Computer simulations of both of these methods are presented. The simulations demonstrate that the post detection processing method produces only moderate improvement in resolution due to signal to noise limitations while the pre-detection method gives very significant improvements. As a part of the simulations, techniques of generating instantaneous realizations of wave fronts deformed by atmospheric turbulence and their corresponding point spread functions are presented. Author

N76-29851 Optical Science Consultants, Yorba Linda, Calif.
HOW MANY PICTURES DO YOU HAVE TO TAKE TO GET A GOOD ONE? **c74**
David L. Fried *In* AGARD Opt. Propagation in the Atmosphere May 1976 11 p refs (For availability see N76-29815 20-46)

In short exposure imaging through turbulence, there is some probability that the image will be nearly diffraction limited because the instantaneous wave front distortion over the aperture was negligible. It is shown that the probability of obtaining a good short exposure image corresponds to a hyperspace integral in which the spatial dimensions are the independent random coefficients in an orthonormal series expansion. It is equal to the probability that a randomly chosen point in the hyperspace will lie within a hypersphere of unit radius, the points in the hyperspace being randomly chosen in accordance with the product of independent Gaussian probability distributions - one distribution for each dimension. The variances of these distributions are directly proportional to the eigenvalues of the Karhunen-Loeve equation. This hyperspace integral (involving up to several hundred dimensions) has been evaluated using Monte Carlo techniques. Author

N76-29852 National Oceanic and Atmospheric Administration, Boulder, Colo.
REMOTE PROBING OF WINDS AND REFRACTIVE TURBULENCE USING OPTICAL TECHNIQUES **c47**
S. F. Clifford *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

Techniques of measuring wind and refractive turbulence by using both active and passive optical sources are considered. A passive wind sensor was developed that requires no active light source; it responds to fluctuations of light reflected from a target to determine the average crosswind. Finally, progress was made in the application of horizontal path techniques to the problem of remotely sensing wind and refractive turbulence profiles aloft from observations of stellar scintillations. The operational principles of these devices are analyzed and their performances compared to more conventional meteorological instruments. Author

N76-29853 California Univ.; La Jolla.
MEASURED VISIBLE SPECTRUM PROPERTIES OF REAL ATMOSPHERES
S. Q. Duntley *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p ref (For availability see N76-29815 20-46)

Measurements of the visible spectrum properties of the atmosphere which govern the apparent contrast of distant objects have been made from aircraft, spacecraft, and ground stations in various parts of the world throughout the past thirty years. Samples of these data are presented and the techniques of measurement that were used are described. Examples are given to illustrate how the data can be used to predict the limiting ranges of detection, recognition, classification, and identification of any specific object by airborne, spaceborne, and ground based observers or imaging devices. Author

N76-29854 Forschungsinstitut Fuer Optik, Tuebingen (West Germany).
PASSIVE AND ACTIVE ATMOSPHERIC VISION
D. H. Hohn *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

The main features of a unique theory of atmospheric passive and active vision for 0.25 micrometer to 14 micrometers are discussed. The signal-to-noise ratio corresponding to the detection of the vision signal, i.e. the apparent radiance of the obervation site, is used as the basic physically limiting magnitude. It establishes a general vision formula. Different noise limitations (detector, device radiation, signal photon noise) were used to derive special, more applicable equations. The theoretical results were applied numerically to passive thermal vision. The optimization of optoelectronic vision systems was considered by approaching signal limited photon noise conditions in contradiction to blip conditions, and by using reduced wavelength bands for atmospheric vision. Finally, the problem of defining and measuring characteristic lengths comparable to the visual range 5 was considered. Author

N76-29855 Physics Lab. RVO-TNO, The Hague (Netherlands).
DECREASE OF CONTRAST IN THE ATMOSPHERE: STATISTICAL PRESENTATION OF THE RESULTS OF DAYTIME AND NIGHT-TIME MEASUREMENTS
J. VanSchie and J. Rogge (Roy. Mil. Acad., Breda, Netherlands) *In* AGARD Opt. Propagation in the Atmosphere May 1976 16 p refs (For availability see N76-29815 20-46)

An outline is given of the model in which the decrease of contrast in the atmosphere in the visible region is described with two parameters: the extinction coefficient and the luminance of the atmosphere; also the distance over which the initial contrast is halved, is introduced. The results of a number of measurements of these parameters, both at day and at night, are presented in the form of several histograms. Some comments concerning the results of the various measurements are given. Author

N76-29856 Norwegian Defence Research Establishment, Kjeller.
BENDING OF RAYS OF LIGHT ABOVE THE SEA SURFACE
P. A. Stokseth and A. Nordbryhn *In* AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs (For availability see N76-29815 20-46)

A temperature difference between the sea and the air above it sets up a stable vertical air temperature gradient in the first few meters above the sea surface. This temperature inhomogeneity causes a similar refractive index gradient. Rays of light passing through this optical inhomogeneous medium are bent, and imaging of objects through this medium may be subject to strong distortion. Such image distortion has been investigated, theoretically and experimentally. The main experimental results were obtained by taking pictures of a suitable test object with a photographic camera and a telephoto lens at 6.2 km range just above the sea surface. From these pictures typical forms and magnitudes of the distortion were found. A mathematical model tracing rays of light through a vertically varying optical medium was used to predict image distortions. The theoretical results have been compared with the experimental results, and good similarity has been found. Author

N76-29857 Marconi-Elliot Avionic Systems Ltd., Basildon (England).
ATMOSPHERIC LIMITATIONS OF ACTIVE AND PASSIVE NIGHT VISION SYSTEMS **c74**
E. G. D. Youngs *In* AGARD Opt. Propagation in the Atmosphere May 1976 7 p refs (For availability see N76-29815 20-46)

The ways in which the earth's atmosphere affect the image quality of night vision devices are discussed, and of particular interest here is the effect on apparent contrast. Atmospheric problems are considered that are associated with the use of supplementary illumination. Continuously emitting searchlights are briefly outlined, and techniques associated with pulsed illuminators are considered. A summary is given of a basic mathematical model for such a system. Author

N76-29858 Eltro G.m.b.H., Heidelberg (West Germany).
USING LIDAR FOR MEASURING VISIBILITY **c36**
James F. Ruger *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

The performance of slant visibility equipment and the data processing techniques used, are described. Special attention is given to the correlation data which compares the accuracy of the slant visibility system to that of a recognized transmissometer. Approximately 800 slant visibility readings were compared with the transmissometer visibility data at three different airports in order to obtain the correlation function. The results show that in slant visibility readings, although consistently higher than the transmissometer visibility reading, the factor is always approximately two. Therefore the correlation factor is a constant, and the visibility data plots of the two systems lie exactly parallel to one another. Author

N76-29859 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE INFLUENCE OF THE ATMOSPHERE BETWEEN HELICOPTERS AND GROUND-TARGETS ON THE DOWNWARD AND UPWARD VISIBILITY **c74**
H.-E. Hoffmann *In* AGARD Opt. Propagation in the Atmosphere May 1976 16 p refs (For availability see N76-29815 20-46)

During some preliminary visibility air-to-ground and ground-to-air tests in autumn 1974, the maximum detection range and the maximum recognition range were determined. A Leopard tank, a 1.5 t military truck and a special test board were observed from air to ground. The experiments took place only at standard visibilities between 36 and 57 km - the maximum detection range ground-to-air was between 6 and 12 km larger than the maximum detection range air-to-ground. The maximum recognition range air-to-ground was up to 2 km smaller than the maximum detection range. The maximum detection range for observations of a special test board was smaller than that for observations of the 1.5 t military truck. The maximum recognition ranges, however, determined at observations of the test board and of the 1.5 t military truck did not differentiate significantly from each other. Author

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-29860# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF THE MODIFIED NAS EN ROUTE STAGE A MODEL 3D WEATHER AND FIXED MAP UNIT Final Report, Sep. 1974 - Jul. 1975
Robert W. Delaney Mar. 1976 57 p
(AD-A024330/3; FAA-NA-75-47; FAA-RD-76-53) Avail: NTIS HC $4.50 CSCL 04/2

A number of changes were requested by Air Traffic Service to improve the operational performance of the National Airspace System (NAS) En Route Stage A Model 3D Weather Subsystem, the basic element of which is the Weather and Fixed-Map Unit (WFMU). Development of design changes was introduced to optimize the weather subsystem effectiveness. These design changes included the elimination of aircraft breakthrough by inhibiting strong aircraft returns displayed as weather contours, provision of moving target indicator (MTI)-log video to the WFMU for improvement in weather contouring when in the MTI mode, and added controls and alignment procedures for reliable WFMU performance. It was concluded that the WFMU was capable of generating reliable contours around weather clutter and was not affected by aircraft signals. Effective control of weather map data rates was accomplished by a new selectable WFMU azimuth resolution design and by a weather discrimination feature in the CD. It is recommended that the WFMU low intensity and high intensity attenuation threshold levels be selected, to 12 and 24 db respectively, for determining contours representative of circular polarization punch through and for establishing an area where moderate turbulence may be encountered. Author

N76-29861*# Texas A&M Univ., College Station.
A SINGLE FIELD OF VIEW METHOD FOR RETRIEVING TROPOSPHERIC TEMPERATURE PROFILES FROM CLOUD-

CONTAMINATED RADIANCE DATA
Donald B. Hodges Washington NASA Aug. 1976 103 p refs
(Contract NAS8-26751)
(NASA-CR-2726; M-174) Avail: NTIS HC $5.50 CSCL 04B

An iterative method is presented to retrieve single field of view (FOV) tropospheric temperature profiles directly from cloud-contaminated radiance data. A well-defined temperature profile may be calculated from the radiative transfer equation (RTE) for a partly cloudy atmosphere when the average fractional cloud amount and cloud-top height for the FOV are known. A cloud model is formulated to calculate the fractional cloud amount from an estimated cloud-top height. The method is then examined through use of simulated radiance data calculated through vertical integration of the RTE for a partly cloudy atmosphere using known values of cloud-top height(s) and fractional cloud amount(s). Temperature profiles are retrieved from the simulated data assuming various errors in the cloud parameters. Temperature profiles are retrieved from NOAA-4 satellite-measured radiance data obtained over an area dominated by an active cold front and with considerable cloud cover and compared with radiosonde data. The effects of using various guessed profiles and the number of iterations are considered. Author

N76-29862# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
DEVELOPMENT AND USE OF THE NCAR GCM
Sep. 1975 186 p refs
(NCAR-TN/STR-101) Avail: NTIS HC $7.50

A steering committee was set up by the National Center for Atmospheric Research (NCAR) to review past and present activities centered around a general circulation model (GCM). The following topics were prepared and discussed by the committee: (1) classification of NCAR GCMs, (2) climatological statistics, (3)model sensitivity for climate simulation, (4) one- to seven-day forecasts of large-scale atmospheric flow generated from the GCM. Decisions were made on research proposals relating to the development and use of GCM, allocating necessary computing and manpower resources and following through on their accomplishments. L.S.

N76-29863*# Stanford Univ., Calif. Inst. for Plasma Research.
A SYNOPTIC APPROACH TO SUN-WEATHER INVESTIGATIONS
John M. Wilcox May 1976 19 p refs
(Grants NGR-05-020-559; NSF ATM-74-19007; NSF DES-75-15664; Contract N00014-76-C-0207)
(NASA-CR-148568; SU-IPR-663) Avail: NTIS HC $3.50 CSCL 04B

The advantages of a regular program of daily observations of the magnetosphere, ionosphere and atmosphere are described. Such synoptic observations may be one of the best routes to understanding the physical mechanisms involved in sun-weather influences. Some specific examples of such observations are given. Author

N76-29864# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: WIND SHEAR
Mar. 1976 71 p
(AD-A025511/7; FAA-ED-15-2) Avail: NTIS HC $4.50 CSCL 01/1

A development plan is presented for solutions to the aviation hazards created by low-level wind shear in the terminal area. The 4-year development program to satisfy National Airspace System user needs for current and predicted information concerning wind shear at the Nation's airports is described. Included in the plan are: (1) efforts to better characterize low-level wind shear, (2) plans to define the hazards of wind shear for the aviation community, (3) tasks required to develop ground-based devices for hazardous wind shear detection and movement, (4) investigations into the use of airborne equipment to detect hazardous wind shear and then either warn the pilot of its presence and/or assist him in coping with it, (5) an outline of how the data collected on wind shear will be processed, analyzed and reported, and (6) provisions for integrating wind shear data into the NAS by developing data formats and displays suitable to users (air traffic control systems, pilots and the National Weather Service). Plans to improve low-level wind shear predictions are presented. The FAA groups and other Federal Government agencies participating in this effort are identified. Program management responsibilities are addressed. A program schedule with milestones is offered, and program funding requirements are part of the plan. Author

N76-29865*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A BALLOON OZONE MEASUREMENT UTILIZING AN OPTICAL ABSORPTION CELL AND AN EJECTOR AIR SAMPLER
Ernest Hilsenrath and Thomas E. Ashenfelter Washington NASA Jul. 1976 12 p refs
(NASA-TN-D-8281; G-7698) Avail: NTIS HC $3.50 CSCL 04A

Stratospheric ozone was measured from a balloon utilizing an ultraviolet absorption cell. The ambient air was sampled by means of an aspirator attached to the output end of the optical cell. A nominal ozone distribution was obtained from 16 km to the float altitude of 38 km. Author

N76-29866# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
DEVELOPMENT OF A PORTABLE ACOUSTIC ECHO SOUNDER
Edward J. Owens May 1974 49 p refs Sponsored in part by RADC
(AD-A021244; NOAA-TR-ERL-298; WPL-31) Avail: NTIS CSCL 04/2

The report describes the design and construction of an inexpensive, portable, monostatic acoustic echo sounder called the Suitcase Sounder. The sounder is used for monitoring atmospheric temperature fluctuations by measuring backscattered echoes of acoustic tone bursts. GRA

N76-29867# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
A SUMMARY OF WEATHER OBSERVED AT CRETE AND SUMMIT STATIONS, GREENLAND, JUNE 1974
M. A. Bilello, C. C. Langway, Jr., and S. Mock Dec. 1975 21 p
(AD-A021227; CRREL-SR-244) Avail: NTIS CSCL 04/2

Daily observations of air temperature, atmospheric pressure, wind speed and direction were made at Crete Station on the Greeland ice sheet from 5 to 24 June 1974. The average air temperature during this period was -16.6C(+2.1F), and ranged from a minimum of -30C(+22F) to a maximum of -6C(-21.2F). The wind speed averaged 7.6 knots and was predominatly from the north. Extended periods of clear or partly cloudy weather were observed, although ground fog and reduced surface visibility occurred simultaneously. During passages of low pressure troughs, light snow, blowing snow and a whiteout were observed; at these times visibility became quite limited. At Summit Station the minimum air temperature observed between 7 and 14 June 1974 was -27C(-16.6F) and the maximum was -13C (+8.6F). These observations, however, were not made during the coldest or warmest part of the day, so the true extremes were probably greater than these. During passage of a low pressure trough at both stations, the pressure at Crete Station dropped 9 mb over a 45-hour period, and that at Summit Station dropped 6 mb over a 37-hour period. GRA

N76-29868# Environmental Prediction Research Facility (Navy), Monterey, Calif.
OBJECTIVE ANALYSIS TECHNIQUE IN SIGMA COORDINATES
Dieter Schiessl Nov. 1975 156 p refs
(AD-A021213; ENVPREDRSCHF-Tech-Paper-20-75) Avail: NTIS CSCL 04/2

A three-step objective analysis technique for initializing Fleet Numerical Weather Central's Primitive Equation Forecast Model in the 63x63 Northern Hemisphere Polar Stereographic Grid is described. In the first step, an analysis is performed at 10 mandatory pressure levels. In the second step, the mandatory pressure level heights are transformed into sigma coordinates by using a mass structure conversion procedure which describes

the physical properties of an air column through static stability parameters over defined pressure increments. In the third step, raw data are converted to sigma coordinates by an identical procedure and reanalyzed in sigma coordinates by using the transformed pressure level analysis as initial guess. The applied numerical analysis method is based on the pattern-conserving analysis technique FIB (Field by Information Blending) which allows wind and height reports to be treated as independent information sets and to be analyzed simultaneously. GRA

N76-29869# Missouri Univ., Columbia. Dept. of Atmospheric Science.
ECONOMIC IMPACTS OF WEATHER VARIABILITY
James D. McQuigg Aug. 1975 264 p refs
(Grants NSF GI-37218; NSF ESR-73-07752-A01)
(PB-252349/6; NSF/RA/E-75-125) Avail: NTIS HC $9.00 CSCL 04B

A quantitative analysis is provided of the interactions between weather and weather-sensitive enterprises. The following weather-dependent relationships are examined: (1) Agriculture with analysis by various crops; (2) forest fire; (3) energy, both demand and alternative energy sources; (4) outdoor activities, including construction, farm machinery, transportation, and recreation; and (5) health of humans, farm animals, and crops. A section is also included on the economics of nonagricultural water usage. Appendix A deals with the 'Use of Principal Components Estimators in Multivariate Regression'. Appendix B contains the 'State Wheat Yield Models'. Both an author and a subject index are included. GRA

N76-29870# Hawaii Univ., Honolulu. Dept. of Meteorology.
AN ANALYSIS OF FOUR SHOWERS WITH RAINFALL RATES 250 mm/HOUR
Charles M. Fullerton and S. Kerry Wilson Jun. 1975 52 p refs
(Contract DI-14-31-0001-5011)
(PB-252191/2; UHMET-75-03; W76-06907; OWRT-B-032-HI(1); TR-90) Avail: NTIS HC $4.50 CSCL 04B

A computer monitored network of rapid-response Raymond-Wilson rainfall intensity gauges is operating at the Cloud Physics Observatory (CPO), on the windward coast of the island of Hawaii, recording the passage of both warm and cold cloud rain showers. During a one-year monitoring period, 57 rainfall events were recorded with intensities > or = 95 mm/hr. Four of these events exhibited rainfall rates > or = 250 mm/hr. Each of these events is analyzed as a case study documenting the network rainfall intensity records, the associated local variations in potential gradient, surface wind velocity and atmospheric pressure, rawinsonde soundings of temperature, dew point and winds, satellite and 250-mb wind data. GRA

N76-29871# Meteorology Research, Inc., Altadena, Calif.
MEASUREMENTS AND PREDICTIONS OF PRECIPITATION DEVELOPMENT IN STRATIFORM ICE CLOUDS Final Report, 1 Jan. - 31 Aug. 1975
Andrew J. Heymsfield 24 Oct. 1975 91 p refs
(Contract F19628-75-C-0117)
(AD-A021467; MRI-75-FR-1381; AFCRL-TR-75-0564) Avail: NTIS CSCL 04/2

During the past two years, Meteorology Research, Inc. (MRI) has been involved in several programs aimed at defining and predicting ice cloud characteristics in a variety of synoptic systems. Aircraft sampling of microphysical parameters in conjunction with simultaneous Doppler radars and radiosonde measurements were used to define not only the cloud ice water content, mean and maximum crystal lengths, precipitation rate, and ice crystal concentrations, but the accompanying air velocities and relative humidity. From the results of this study, the ice water content was parameterized in terms of the vertical velocity and relative humidity. Using these equations, as well as those derived for evaporative layers, a detailed model was developed for ice water content and precipitation rate prediction from radiosonde data. This technique was applied to cases where simultaneous aircraft measurements were available in the Continental United States and at Kwajalein in the Marshall Islands, and excellent agreement was obtained. GRA

N76-29872# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
INTERACTION OF A BUOYANT TURBULENT ROUND JET WITH A CO-FLOWING WIND Air Force Surveys in Geophysics
M. M. Klein and Bruce A. Kunkel 11 Nov. 1975 39 p refs (AF Proj. 2093)
(AD-A021470; AFCRL-TR-75-0581; AFCRL-AFSG-332) Avail: NTIS CSCL 04/2

A broad effort is being conducted to develop an operational Warm Fog Dispersal System (WFDS) using ground-based heat sources. In order to determine the optimum heat and thrust for the combustors in the WFDS, investigations have been made of the buoyant motion in round- and plane-heated turbulent jets in co-flowing (that is, same direction) wind fields. This report describes a method of calculating the round jet case. The method can be used for jet velocities of 100m/sec or less, wind velocities below or equal to the jet velocity, and jet temperatures up to 3 times the ambient value. Initial jet velocities of 5 and 20m/sec and temperature excesses, relative to the ambient temperature, of .3 and 1 were selected for the calculations.GRA

N76-29873# Army Electronics Command, Fort Monmouth, N.J.
ON THE SPECTRUM ANALYSIS OF BINARY DATA
Elton P. Avara Nov. 1975 29 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A022318; ECOM-5580) Avail: NTIS CSCL 04/2

Characteristics of the spectra of binary data are investigated by use of a two-state, linear, first-order Markov model for the data. Examples of binary data are: rain-no rain, fog-no fog, clear-cloudy, sunlight-no sunlight, etc. Some statistical properties of the sample autocovariances and spectral densities of such data are presented and compared with corresponding empirical results. Author (GRA)

N76-29874# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
A DIGITAL DATA ACQUISITION INTERFACE FOR THE SMC DIRECT READOUT GROUND STATION: CONCEPT AND PRELIMINARY DESIGN
George D. Alexander Fort Monmouth, N. J. Oct. 1975 27 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A022317; ECOM-5577) Avail: NTIS CSCL 22/2

General specifications are generated for hardware and software that will permit retrieval, preprocessing, and storage of digital meteorological satellite imagery data that are presently available to researchers only in analogue (transparency) format. Author (GRA)

N76-29875# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SPECIFICATION OF CURRENT AND FUTURE CLOUD AMOUNTS AND CEILINGS FROM SATELLITE DATA Air Force Surveys in Geophysics
John H. Conover 9 Dec. 1975 28 p refs
(AF Proj. 6698)
(AD-A021895; AFCRL-TR-75-0626; AFCRL-AFSG-334) Avail: NTIS CSCL 04/2

Objective methods and their accuracies for deriving current and six-hour forecasts of cloud amount and ceiling from satellite data are presented. Data from the visible and IR window bands were tested to develop relationships. The IR data did not significantly improve the results. The visible data were carefully calibrated, navigated, and normalized for solar elevation and bidirectional reflectance. Cloud motions were also used for the six-hour forecasts. The data were reduced to values of average brightness and its standard deviation over 1/2 deg by 1/2 deg areas before analysis. RMSE of current cloud amounts (on a scale of 0 to 1) are about 0.25 and for six hours later about 0.35. The occurrence of a ceiling/no ceiling was specified correctly 80% and 70% of the time at zero and six hours, respectively. Various methods are shown for minimization of ceiling errors over different height ranges. In general, RMSE of specified and forecast ceilings range from 4,000 to 6,000 ft at low levels to 9,000 to 10,000 ft at mid and high levels. Author (GRA)

N76-29876# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE USE OF SATELLITE DATA TO MAP EXCESSIVE CLOUD MASS Environmental Research Papers
James T. Bunting and John H. Conover 6 Jan. 1976 21 p refs
(AF Proj. 627A)
(AD-A021896; AFCRL-TR-76-0004; AFCRL-ERP-544) Avail: NTIS CSCL 04/2

A preliminary report on a method to estimate cloud ice and water content from archived satellite data is presented. The ultimate purpose is the identification and mapping of clouds with excessive mass to produce a climatology for the SAMSO ABRES program. The only suitable archive of satellite data consists of visible and infrared (IR) window measurements taken by scanning radiometers on board NOAA satellites. Starting in 1973, these measurements have been archived digitally each day in 2048 X 2048 arrays covering each hemisphere. In this report, the visible and IR window measurements are related to cloud mass by simultaneous observation of clouds from satellites and aircraft in 11 cases taken in 1974. Additional cases (including 24 in 1975) will be included in subsequent reports. The satellite data and archive are described. Results of the 1974 cases are given in the form of a simple scattergram relating cloud mass integrated through all altitudes to the joint measurements of IR temperature and visible luminance of the cloud. A preliminary application of the scattergram to a cyclonic storm on 23 and 24 July 1973 is made to identify areas of high cloud mass.
Author (GRA)

N76-29877# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A COMPARISON BETWEEN OBSERVED AND DEDUCED MEAN MONTHLY WINDS FROM 700 mb TO 200 mb Environmental Research Papers
Arthur J. Kantor 22 Jan. 1976 29 p
(AF Proj. 8624)
(AD-A021897; AFCRL-TR-76-0044; AFCRL-ERP-548) Avail: NTIS CSCL 04/2

Differences between mean monthly winds obtained from actual observations and geostrophic wind derived from mean monthly altitudes of constant-pressure surfaces are examined for January and July at four levels between 10,000 and 40,000 ft. Differences in speed for both east-west and north-south components are significantly and unexpectedly large. These results demonstrate the advantage of using observed winds rather than deduced values to provide climatic winds at altitudes between 10,000 and 40,000 ft. Modification of the existing system to include winds from actual observations wherever and whenever possible is recommended. Author (GRA)

N76-29878# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A GENERALIZED VERSION OF THE FIELDS BY INFORMATION BLENDING (FIB) TECHNIQUE
Byron R. Maxwell Feb. 1976 90 p refs
(WF52551713)
(AD-A021638; ENVPREDRSCHF-Tech-Note-24) Avail: NTIS CSCL 04/2

This report describes a generalized version of the Fields by Information Blending (FIB) technique for generating a scalar analysis. Several highly successful versions of the FIB were developed for operational use at the Fleet Numerical Weather Central. These versions are restricted to the analysis of a particular variable such as sea level pressure, surface winds, or sea surface temperature on a fixed grid projection such as the FNWC 63 x 63 polar stereographic projection. The generalized version described in the report can be used for the analysis of any scalar variable on a prescribed but variable rectangular domain. The report includes a detailed discussion of the underlying principles of the FIB and a basic evaluation of this generalized version for some selected test cases. GRA

N76-29879# RAND Corp., Santa Monica, Calif.
THE PROBLEM OF CLIMATE: A REVIEW FOR THE NONSPECIALIST
W. L. Gates Aug. 1975 17 p refs
(AD-A021709; P-5472) Avail: NTIS CSCL 04/2

This paper was originally prepared as a contribution to a report of the Committee on Atmospheric Sciences of the National Academy of Sciences whose intention was to survey problems and opportunities in selected aspects of the atmospheric sciences for a nontechnical audience. In this spirit, this essay attempts to discuss the problem of climate without the use of mathematical equations or specific literature references, and with a minimum of technical illustrations. However, the Academy's report was not published, and therefore this paper is being reproduced here in order to achieve an initial distribution among those portions of the general scientific and administrative audience which may be interested in this increasingly important problem.
Author (GRA)

N76-29852 National Oceanic and Atmospheric Administration, Boulder, Colo.
REMOTE PROBING OF WINDS AND REFRACTIVE TURBULENCE USING OPTICAL TECHNIQUES
S. F. Clifford *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-29880*# California Univ., Los Angeles.
OCEANIC LITHOSPHERE AND ASTHENOSPHERE: THE THERMAL AND MECHANICAL STRUCTURE
G. Schubert, (Paris Univ., Orsay), C. Froidevaux, and D. A. Yuen 4 Feb. 1976 93 p refs Revised
(Grants NsG-7002; NSF GA-40749)
(NASA-CR-148595) Avail: NTIS HC $5.00 CSCL 08J

A coupled thermal and mechanical solid state model of the oceanic lithosphere and asthenosphere is presented. The model includes vertical conduction of heat with a temperature dependent thermal conductivity, horizontal and vertical advection of heat, viscous dissipation or shear heating, and linear or nonlinear deformation mechanisms with temperature and pressure dependent constitutive relations between shear stress and strain rate. A constant horizontal velocity u sub 0 and temperature t sub 0 at the surface and zero horizontal velocity and constant temperature t sub infinity at great depth are required. In addition to numerical values of the thermal and mechanical properties of the medium, only the values of u sub 0, t sub 0 and t sub infinity are specified. The model determines the depth and age dependent temperature horizontal and vertical velocity, and viscosity structures of the lithosphere and asthenosphere. In particular, ocean floor topography, oceanic heat flow, and lithosphere thickness are deduced as functions of the age of the ocean floor. Author

N76-29881# Woods Hole Oceanographic Institution, Mass.
PREDICTION AND MEASUREMENT OF THE STABILITY OF THE IWEX TRIPOD MOORING
N. N. Panicker and D. W. Schmidt Jan. 1975 59 p refs
(Contract N00014-74-C-0262; NR Proj. 083-004)
(AD-A018700; WHOI-75-46) Avail: NTIS CSCL 08/3

The three-dimensional array of sensors for the Internal Wave Experiment (IWEX) was supported on a tripod mooring rising from the sea floor to a height of 5 km in mid-ocean of 5-1/2 km water depth. The mooring was so designed that the current-induced motions of the mooring would be small. Computer simulation was used for optimizing the mooring design to acheive this purpose. Nine precision pressure recorders were deployed at selected positions on the mooring and the results of analysis of the records are presented. The local tide time series are generated and subtracted from the pressure records to obtain the vertical excursions of the mooring. A five-term expression is used to convert pressure measured in decibars to depth in meters. The predicted displacements and the measured values are compared and found to agree. The mooring motion was found in general to be small enough to contribute insignificant noise to the velocity measurements. Author

N76-29882# R and D Associates, Marina Del Rey, Calif.
AUSEX ROUGH OCEAN ISSUES
S. C. Lubard, P. M. Hurdle, and J. V. Sanborn Nov. 1975 49 p refs
(Contract N00014-76-C-0265)
(AD-A020751; RDA-TR-2400-003) Avail: NTIS CSCL 08/3

In this report, the available ocean wave models are presented and used to estimate the mean square slope components in the deep ocean. These ocean models are also used to interpret the AUSEX experimental results and improve the theoretical modeling predictions. Author (GRA)

N76-29883# Coast Guard, Washington, D.C.
OCEANOGRAPHIC OBSERVATIONS: NOVA SCOTIA TO CAPE HATTERAS, NORTH CAROLINA. OCTOBER - NOVEMBER 1969 AND MAY - JUNE 1970
Richard M. Hayes Jan. 1975 265 p refs
(AD-A020308; USCG-373-66) Avail: NTIS CSCL 08/10

A volumetric statistical T - S analysis of water masses is presented for two Coast Guard oceanographic cruises in support of the International Commission for the Northwest Atlantic Fisheries, from 25 Oct. - 22 Nov. 1969 and 19 May-9 June 1970. The fall cruise data exhibited a 54 percent greater volume of Gulf Stream water in the survey area than the spring cruise, a result of a Gulf Stream meander which brought large volumes of tropical water into the slope region. Effectively the Gulf Stream meanders resulted in an exchange of water masses bringing oceanic water into the coastal zone and vice versa. Seasonal changes in the geostrophic conditions shoreward of the Gulf Stream may influence the extent of intrusion of that water mass into the continental shelf region. GRA

N76-29884# Arctic Inst. of North America, Washington, D.C.
TIME SERIES OF TEMPERATURE MICROSTRUCTURE IN THE ARTIC OCEAN Final Report, Mar. - Apr. 1970
D. E. Amstutz and V. T. Neal Oct. 1975 62 p refs Prepared in cooperation with Oregon State Univ., Corvallis
(Contract N00014-70-A-0219-0001; NR Proj. 307-105)
(AD-A020158; ONR-432:2; Ref-75-18) Avail: NTIS CSCL 08/10

After describing the apparatus used for sampling ocean microstructure from an ice island in the Arctic Ocean, this report discusses vertical thermal microstratification at the upper and lower limits of the Atlantic water on the basis of a spectral analysis of the data. It recommends further analyses of the data which could provide a better understanding of internal wave propagation within a stepped thermal structure. GRA

N76-29885# Environmental Prediction Research Facility (Navy), Monterey, Calif.
ISLAND BARRIER EFFECTS ON SEA STATE AND ATMOSPHERIC MOISTURE AS DETECTED BY A NUMERICAL WAVE MODEL AND SENSORS OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)
R. W. Fett and Kevin Rabe Oct. 1975 69 p refs
(WF52551713)
(AD-A020304; EPRF-TP-18-75) Avail: NTIS CSCL 08/3

Bow wave effect, Swells Marine, DMSP Defense meteorological Satellite Program, Defense meteorological satellite program Island barrier effects on sea state and atmospheric moisture have been studied through use of numerical wave model and examination of data from the Defense Meteorological Satellite Program (DMSP). It is found that calm areas do not extend an appreciable distance downstream. However, swell refraction effects cause a reduction in swell heigh, a change in swell period, and a reorientation of swell direction, long distances to the island's lee, which may account for the satellite-observed reflective patterns noted in sunglint situations over those areas. Bow-wave effects appear to be similarly observed due to sunglint from reoriented swell patterns. In conditions of a strong low-level inversion, DMSP data, being sensitive to water vapor absorption, reveal dry plumes extending downwind from islands. These dry plumes are apparently caused by the islands drying effect on on atmospheric flow as it passes over and is influenced by topographical features of the island barrier. Author (GRA)

N76-29886# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
AN EFFECT OF PERMEABILITY ON SAND TRANSPORT BY WAVES
Karl E. B. Lofquist Dec. 1975 77 p refs
(AD-A020641; CERC-TM-62) Avail: NTIS CSCL 08/3

Permeability effects on the movement of sand in oscillatory flows are observed in laboratory experiments which approximate prototype conditions at the seabed under progressive waves. A natural sand is used, wave periods range between 3 and 14 seconds, and sand surfaces are naturally rippled. The apparatus has a symmetry which removes all effects, except those of permeability, which might cause a net movement of sand. Onshore and offshore directions are determined by phase relationships between the horizontal flows and superposed vertical permeability flows. A positive permeability effect is found, in that the ripple profiles move in the onshore direction. The velocity of this motion is measured and described in a simple dimensionless plot. The associated net transport of sand is not observed directly but can be inferred, to an extent, from the motions of the ripple profiles. The effects of permeability are cumulative and can be significant in coastal processes of long duration. Any estimate of the local rate of sand transport onshore due to permeability involves the distribution of permeabilities within the seabed which are largely unknown. An overall estimate is less than 1 cubic meter per meter of shoreline per year, which is negligible for most engineering considerations. Author (GRA)

N76-29887# Woods Hole Oceanographic Institution, Mass.
GAUSSIANITY OF THE CURRENT AND TEMPERATURE DATA FROM THE TRIMOORED INTERNAL WAVE EXPERIMENT (IWEX)
Lucio Iida and Melbourne G. Briscoe Dec. 1975 72 p refs Prepared in cooperation with Appl. Phys. Lab., Johns Hopkins Univ., Laurel, Md.
(Contract N00014-76-C-0197; NR Proj. 083-400)
(AD-A020760; WHOI-75-67) Avail: NTIS CSCL 08/3

This report describes the time variability of the Gaussianity of the East and North velocity components, and the Up (vertical displacement) variable of the Internal Wave Experiment (IWEX). In order to use the classical Chi-square and Two-Tailed Kolmogorov-Smirnov goodness-of-fit tests on a Gaussian distribution, one must consider the correlation structure of the data, i.e., the non-white spectral characteristics of the three variables. Starting with artificially generated random time series that are white in frequency space, the Gentleman and Sande (1966) method is used to incorporate desired spectral shapes into the series. Three frequency filters modeling the internal wave power spectrum very roughly and to different degrees of accuracy are used in the simulations. These in turn are used to find for the two goodness-of-fit tests new confidence levels that recognize the presence of an internal wave-like correlation structure in the data series. The evolution of the Gaussianity of East, North, and Up throughout IWEX is briefly discussed. Since no considerations were given to the frequency-domain behavior of the data, other than the overall spectral shape for use in generating the artificial data, this report is a preliminary study only, because the temporal evolution of the Gaussianity of the various frequency bands in the internal wave field is the underlying question of importance to study of internal wave self and external interactions. GRA

N76-29888# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ANNOTATED BIBLIOGRAPHY ON THE GEOLOGIC, HYDRAULIC, AND ENGINEERING ASPECTS OF TIDAL INLETS Final Report
John H. Barwis Jan. 1976 344 p refs
(AD-A020355; WES-GITI-4) Avail: NTIS CSCL 08/8

Abstracts and annotations are given for about 1,000 published and unpublished reports, dated 1973 and earlier, on the geologic and engineering aspects of tidal inlets. Insofar as they relate to inlets, references are given on tidal hydraulics, engineering structures, littoral processes, stratigraphy and geologic history, coastal aerial photography, and Corps of Engineers reports of investigation of individual inlets. GRA

N76-29889# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
TIDAL PRISM - INLET AREA RELATIONSHIPS Final Report

James T. Jarrett Feb. 1976 60 p refs
(AD-A022327; WES-GITI-3) Avail: NTIS CSCL 08/3

The tidal prism - inlet area relationships for inlets on sandy coast established by M.P. O'Brien (1931 and 1969) were reanalyzed using his data and data published by other investigators. In addition, tidal prism and inlet cross-sectional area data developed in the Inlet Classification Study were also used. These data result in a total of 162 data points for 108 inlets--59 located on the Atlantic coast, 24 on the Gulf coast, and 25 on the Pacific coast of the United States. The data are grouped into three main categories; (1) all inlets, (2) unjettied and single-jettied inlets, and (3) inlets with two jetties. Regression analysis was performed on each set of data to determine the equations of best fit and to establish 95% confidence limits for the equations and the constants in the equations. The results of the regression analysis indicate that the tidal prism inlet area relationship is not a unique function for all inlets but varies depending on inlet location and whether or not the inlet has been stabilized with a dual jetty system. GRA

N76-29890# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
A LARGE-APERTURE ACOUSTIC ARRAY TO OBSERVE OCEANIC DENSITY STRUCTURES Final Summary Report
G. Thomas Kaye 1 Dec. 1975 17 p
(Contracts N00014-69-A-0200-6038; N00014-69-A-0200-6048; ARPA Order 2127)
(AD-A021325; MPL-U-107/75; SIO-Ref-75-33) Avail: NTIS CSCL 08/3

A large aperture, planar hydrophone array, with sound source, has been constructed and operated by the Marine Physical Laboratory. The Scattering Array (SCAR) is being used as a remote sensing device to observe the density distribution in the oceanic water column. The array of 128 elements is towed to sea, submerged and suspended from a surface vessel. Real-time digital array phasing will allow discrimination between specular reflection (density layering) and point scatterers (biota).
Author (GRA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-29891* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF DETECTING AND COUNTING BACTERIA Patent
Grace L. Picciolo and Emmet W. Chappelle, inventors (to NASA) Issued 27 Jul. 1976 6 p Filed 5 Mar. 1975 Supersedes N75-21921 (13 - 13, p 1548) Continuation-in-part of abandoned US Patent Appl. SN-475337, filed 31 May 1974
(NASA-Case-GSC-11917-2; US-Patent-3,971,703; US-Patent-Appl-SN-475337; US-Patent-Appl-SN-555641; US-Patent-Class-195-103.5R) Avail: US Patent Office CSCL 06M

An improved method is provided for determining bacterial levels, especially in samples of aqueous physiological fluids. The method depends on the quantitative determination of bacterial adenosine triphosphate (ATP) in the presence of nonbacterial ATP. The bacterial ATP is released by cell rupture and is measured by an enzymatic bioluminescent assay. A concentration technique is included to make the method more sensitive. It is particularly useful where the fluid to be measured contains an unknown or low bacteria count. Official Gazette of the U.S. Patent Office

N76-29892*# Oregon Univ., Portland. Dept. of Neurology.
DEFINITION OF PERFORMANCE SPECIFICATIONS FOR AUTOMATED ANALYTICAL ELECTROPHORESIS FACILITY (AAEF) Final Report, 7 Apr. 1975 - 29 Feb. 1976
D. E. Brooks 29 Feb. 1976 137 p refs
(Contract NAS8-31386)
(NASA-CR-149957) Avail: NTIS HC $6.00 CSCL 06B

In order to provide specifications for the automated Analytical Electrophoresis Facility (AAEF) that would satisfy the broadest variety of demands of a future user community, a survey was carried out of all those people who were identified as having published papers on cell electrophoresis in the past four years. A computer search was conducted of the relevant literature from which a list of 87 investigators was derived and defined as the user community for purposes of the mailing. A questionnaire was developed covering the areas of performance which required definition which was subsequently circulated to the user community. Based on the response to this survey performance specifications were assembled. Author

N76-29893# Wisconsin Univ. - Parkside, Kenosha.
EFFECTS OF EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELDS ON PHYSARUM POLYCEPHALUM Technical Report, 15 Sep. 1971 - 31 Dec. 1975
E. M. Goodman, Ben Greenbaum, and Michael T. Marron 1 Feb. 1976 67 p refs
(Contract N00014-76-C-0180; NR Proj. 201-126)
(AD-A021457) Avail: NTIS CSCL 06/18

When the myxomycete Physarum polycephalum is exposed to sinusoidal (45, 60, 75 Hz) or modulated (76 Hz) electromagnetic fields, the mitotic cycle is lengthened, shuttle streaming period is slowed, and the rate of respiration is depressed. Further, modulated fields appear to induce these alterations sooner and at lower intensities than sinusoidal waves. The findings so far do not admit a conclusion that exposure to weak ELF electromagnetic fields is deleterious for Physarum (or other organisms); it can be concluded, however, that these fields do significantly affect biological processes. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-29894* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MINIATURE INGESTIBLE TELEMETER DEVICES TO MEASURE DEEP-BODY TEMPERATURE Patent
Jack M. Pope and Thomas B. Fryer, inventors (to NASA) Issued 27 Jul. 1976 5 p Filed 27 Oct. 1972 Supersedes N73-14093 (11 - 05, p 0503)
(NASA-Case-ARC-10583-1; US-Patent-3,971,362; US-Patent-Appl-SN-301418; US-Patent-Class-128-2P; US-Patent-Class-128-2H; US-Patent-Class-128-2.1A) Avail: US Patent Office CSCL 06B

A telemetry device comprised of a pill-size ingestible transmitter developed to obtain deep body temperature measurements of a human is described. The device has particular utility in the medical field where deep body temperatures provide an indication of general health.
Official Gazette of the U.S. Patent Office

N76-29895* National Aeronautics and Space Administration. Pasadena Office, Calif.
MYOCARDIUM WALL THICKNESS TRANSDUCER AND MEASURING METHOD Patent
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), Robert H. Silver (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Issued 27 Jul. 1976 6 p Filed 5 May 1975 Supersedes N75-22689 (13 - 14, p 1652) Sponsored by NASA
(NASA-Case-NPO-13644-1; US-Patent-3,971,363; US-Patent-Appl-SN-574218; US-Patent-Class-128-2S; US-Patent-Class-128-2.05R; US-Patent-Class-338-6) Avail: US Patent Office CSCL 06B

A miniature transducer for measuring changes of thickness of the myocardium is described. The device is easily implantable without traumatizing the subject, without affecting the normal muscle behavior, and is removable and implantable at a different muscle location. Operating features of the device are described.
Official Gazette of the U.S. Patent Office

N76-29896* National Aeronautics and Space Administration. Pasadena Office, Calif.
CATHETER TIP FORCE TRANSDUCER FOR CARDIOVASCULAR RESEARCH Patent
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), Robert H. Silver (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Issued

27 Jul. 1976 5 p Filed 16 May 1975 Supersedes N75-25598 (13 - 16, p 2022) Sponsored by NASA
(NASA-Case-NPO-13643-1; US-Patent-3,971,364; US-Patent-Appl-SN-578241; US-Patent-Class-128-2S; US-Patent-Class-128-2.05E; US-Patent-Class-128-2.06E; US-Patent-Class-128-418; US-Patent-Class-128-419P; US-Patent-Class-73-398AR) Avail: US Patent Office CSCL 06B

A force transducer for measuring dynamic force activity within the heart of a subject essentially consists of a U-shaped beam of low elastic compliance material. Two lines extend from the beams's legs and a long coil spring is attached to the beam. A strain gauge is coupled to one of the beam's legs to sense deflections thereof. The beam with the tines and most of the spring are surrounded by a flexible tube, defining a catheter, which is insertable into a subject's heart through an appropriate artery. The tines are extractable from the catheter for implantation into the myocardium by pushing on the end of the spring which extends beyond the external end of the catheter.
Official Gazette of the U.S. Patent Office

N76-29897* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 156)
Jul. 1976 62 p refs
(NASA-SP-7011(156)) Avail: NTIS HC $4.00 CSCL 06E

This bibliography lists 170 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1976. Author

N76-29898*# Cornell Univ., New York. Lab. of Neurobiology.
CENTRAL NEURAL MECHANISMS GOVERNING POSTURAL CARDIOVASCULAR MECHANISMS Final Technical Report, 15 Jun. 1972 - 14 Jun. 1976
Donald J. Reis 14 Jun. 1976 293 p refs
(Grant NGR-33-010-179)
(NASA-CR-148603) Avail: NTIS HC $9.25 CSCL 06P

The results of the vestibular apparatus and cerebellum in orthostatic reflex control are summarized. Mechanisms within the brain which govern circulation reflexes and the consequences of disturbances in their function are also included. Author

N76-29899# Polish Academy of Sciences, Warsaw.
THERMAL EFFECT IN THE SOFT TISSUE FOR THE CASE OF FOCUSED ULTRASONIC FIELDS OF SHORT DURATION TIME
Leszek Filipczynski 1 Dec. 1975 19 p refs In POLISH; ENGLISH summary
Avail: NTIS HC $3.50

The temperature rise in the soft tissue was estimated for the case of focused ultrasonic beams as used in ultrasonography. Solving the heat conduction equation with the use of Laplace a transform a formula was obtained which makes it possible to calculate the approximate temperature distribution, in the focus prependicularly to the beam axis, as a function of time. The temperature increase for a 1 s pulse duration is of the same order as obtained in other experiments. For the ultrasonic dosage of 200 W/sq cm and 1 s time duration which corresponds with the threshold values for irreversible changes in the brain, a temperature rise of 33 C is obtained. F.O.S.

N76-29900# Oak Ridge National Lab., Tenn. Carcinogenesis Program.
INTERACTIONS OF CARCINOGENS WITH HUMAN CELL DNA: DAMAGE AND REPAIR
J. D. Regan 1975 18 p refs Presented at the Satellite of IUPHAR Cong., Turku, Finland, 25 Jul. 1975 Sponsored by ERDA
(Conf-750745-1) Avail: NTIS HC $4.00

The DNA of human cells was exposed to UV radiation, gamma radiation, N-acetoxyacetoamino fluorene, 4-nitroquinoline oxide, ethyl methane sulfonate, propane sultone, and ICR-170. Following dBrVrd incubation and exposure to 313 nm radiation the number of strand breaks was recorded; the number of dBrVrd nucleotides inserted was also recorded. The significance of the results is discussed. NSA

N76-29901# Travenol Labs., Inc., Morton Grove, Ill.
TOXICITY OF COMPONENTS OF PLASTIC HAVING CONTACT WITH BLOOD Final Technical Progress Report, Jun. 1972 - Mar. 1975
J. E. Miripol, P. J. Garvin, I. J. Stern, and R. F. Wallin Sep. 1975 340 p refs
(Contract HB-22990)
(PB-251742/3; NIH-N01-HB-22990) Avail: NTIS HC $10.00 CSCL 06T

Changes in the apparent volume of distribution of Di-(2-ethylhexyl) phthalate (DEHP) observed when acqueous suspensions were used for injection of the plasticizer indicated that differences in the systemic disposition and distribution of DEHP were dependent on the physical state of the dosage form. Whole body autoradiographic studies performed on mice infused with serum containing 14C-DEHP showed rapid accumulation labeled carbon in the kidney and liver with rapid excretion into urine, bile, and intestine. Essentially all the labeled compound was excreted within 24 hours. Rats infused twice weekly for 60 days with rat plasma containing DEHP extracted from PVC exhibited no toxicologically significant changes when compared to controls. GRA

N76-29902# Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF OXIDANT AND SULFATE INTERACTION ON PRODUCTION OF LUNG LESIONS Final Report
Gustave Freeman and Laszlo T. Juhos Jan. 1976 29 p
(Contract EPA-68-02-1944)
(PB-251729/0; EPA-600/1-76-009) Avail: NTIS HC $4.00 CSCL 06T

An investigation is presented that was designed to determine the sub-acute and chronic effects of sulfuroxide inhalation alone and in combination with oxidant exposure on the respiratory system of laboratory animals. Preliminary experiments were being conducted to determine the optimum concentration of small-particle H2SO4 exposure to use in subsequent H2SO4-oxidant experiments. The comparative response of rats, guinea pigs and monkeys was determined. The effects of SO2-O3 mixtures were determined also. The principal biologic responses studied were the histopathologic response, including ultrastructural studies and autoradiographic assessment of cell turnover rates, biochemical studies and physiologic measurements. GRA

N76-29903# Southwest Research Inst., San Antonio, Tex.
BASELINE LEVELS OF PLATINUM AND PALLADIUM IN HUMAN TISSUE Final Report
Donald E. Johnson, R. John Prevost, John B. Tillery, David E. Camann, and John M. Hosenfeld Mar. 1976 252 p refs
(Contract EPA-68-02-1274)
(PB-251885/0; EPA-600/1-76-019) Avail: NTIS HC $9.00 CSCL 06T

The objective is to determine baseline levels of platinum and palladium in the population and environment prior to wide-spread use of catalyst-equipped vehicles. Lead is determined to ascertain the future epidemiological effect of non-leaded gasoline. The report presents the results of an epidemiological study of populations living near a freeway in Los Angeles, California and in the high desert region of Lancaster, California, for concentrations of platinum, palladium, and lead in blood, urine, hair, feces, autopsy tissues, ambient air, surface water and soil. Platinum and palladium are determined in samples from miners in Sudbury, Ontario, Canada, and metal refinery workers in New Jersey. Analytical methods are developed for platinum, palladium, and lead using atomic absorption spectrophotometry. GRA

N76-29904# Desmatics, Inc., State College, Pa.
RESEARCH ON CONSTRUCTION OF A STATISTICAL MODEL FOR PREDICTING IMPACT ACCELERATION INJURY
Dennis E. Smith Feb. 1976 35 p refs
(Contract N00014-74-C-0154; NR Proj. 105-757)
(AD-A021669; TR-102-2) Avail: NTIS CSCL 06/19

This report describes a statistical approach to development of a human impact acceleration injury prediction model based on experimental data obtained from human analogs. Also discussed is the use of preinjury criteria to provide more accurate estimates of model parameters. Author (GRA)

N76-29905# Optical Sciences Group, San Rafael, Calif. Visual Sciences Div.
INFLUENCE OF SOCIALLY USED DRUGS ON VISION AND VISION PERFORMANCE Annual Report, 1974 - 1975
Anthony J. Adams, Brian Brown, Merton C. Flom, Arthur Jamolsky, and Reese T. Jones 1 Apr. 1975 115 p refs
(Contract DADA17-73-C-3106)
(AD-A022024; Rept-751) Avail: NTIS CSCL 06/16

Eight visual functions were measured in these experiments; twenty-seven experienced marijuana and alcohol users participated. The experiments were performed double blind with placebo controls. The results are: (1) Dynamic visual acuity is reduced in dose-related-fashion by both alcohol and marijuana; (2) Alcohol produces large, dose-related increases in time taken to recover foveal sensitivity after bright light exposure; (3) Recovery of contrast sensitivity function in the peripheral retina after exposure to a bright light flash is prolonged by 1.0 ml/kg alcohol; (4) The maximum velocity of sinusoidal tracking is markedly reduced by alcohol and not by marijuana. This effect for the smooth pursuit system and the saccadic eye movement system is dose related for both systems; (5) Using power spectrum analysis, the investigators (a technique which allows examination of individual frequency components of eye movements), we the investigators have demonstrated alcohol and marijuana induced deficits in oculomotor tracking; (6) Color discrimination appears to be significantly reduced after alcohol (1.0 ml/kg) and marijuana (15 mg THX) in the blue region without apparent change in other spectral regions; (7) Static visual acuity, is unaffected by alcohol or marijuana in doses up to 1.0 ml/kg of alcohol and 15 mg THC; and (8) Peripheral gaze nystagmus is increased after alcohol and to a lesser extent after marijuana ingestion.
GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-29906# Civil Aeromedical Inst., Oklahoma City, Okla.
EFFECTS OF GROUND TRAINER USE ON THE PSYCHOLOGICAL AND PHYSIOLOGICAL STATES OF STUDENTS IN PRIVATE PILOT TRAINING
Roger C. Smith and C. E. Melton, Jr. Mar. 1976 9 p refs
(AD-A024704/9; FAA-AM-76-2) Avail: NTIS HC $3.50 CSCL 05/9

Student pilots receiving all instruction in an aircraft and student pilots who received a portion of their flight training in a ground trainer were compared in terms of flying proficiency, psychological (anxiety) states during training, and certain physiological measures. It was found that pilot performance was equal in both groups, as measured by objective ratings and check pilot observations. There was no evidence that student pilot anxiety was differentially influenced by these two training procedures, although anxiety did vary as a function of the type of flight (dual, solo, evaluation). There were some trends in the physiological data to suggest slightly more favorable conditions in the ground trainer. No contraindications to ground trainer use were evident.
Author

N76-29907# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF PILOT SELF-BRIEFING TECHNIQUES. VOLUME 1: METHODOLOGY, RESULTS, AND RECOMMENDATIONS Interim Report, Mar. - Oct. 1974
Hugh D. Milligan and Bruce L. Rosenberg Feb. 1976 83 p
(AD-A024645/4; FAA-NA-75-18-Vol-1; FAA-RD-75-90-Vol-1) Avail: NTIS HC $5.00 CSCL 05/9

A study was conducted to assess the usefulness of automation techniques and devices developed for the purpose of providing pilots with the capability to obtain preflight weather briefings without the aid of a flight service station specialist. Both live and canned weather data were employed during the conduct of the study to ascertain the validity of the basic concepts and to define improvements thereto. The data elicited from the activities, thus far, indicates that pilot self-briefing is a feasible approach which portends delivery of quality weather briefings with a concomitant cost reduction when compared to the cost of today's and any future labor intensive briefing system. This is a technical report containing information on design of the experiment; data collected, statistical analyses of results, and a summary narrative, conclusions and recommendations. Volume I contains the textual presentation of the experiments as well as the analyses and some tables presenting overall pilot responses.
Author

N76-29908# Federal Aviation Administration, Oklahoma City, Okla.
AN EVALUATION OF THE EFFECTIVENESS OF THE FAA MANAGEMENT TRAINING SCHOOL
Roger C. Smith, Barbara Rana, and Deborah K. Taylor Sep. 1975 46 p refs
(AD-A025254/4; FAA-AM-75-9) Avail: NTIS HC $4.00 CSCL 05/9

An assessment of the FAA Management Training School (MTS) program is presented. Questionnaires for evaluating the MTS experience in terms of the usefulness and the quality of specific and general aspects of the course were presented to graduates at various FAA field offices and facilities. It was found that supervisors and managers felt that the program had been useful in helping them to meet the demands of their positions. Areas in need of improvement are indicated. Questionnaires concerning specific types of behavior desired of supervisors and managers were completed by graduates of MTS, their immediate supervisors, and their employees and also by supervisors and managers not trained at MTS. It was found that MTS training resulted in an increase in desirable on-the-job activities of MTS graduates.
Author

N76-29909*# McDonnell-Douglas Astronautics Co., Houston, Tex. Astronautics Div.
CONTINUATION OF ADVANCED CREW PROCEDURES DEVELOPMENT TECHNIQUES Final Report
J. D. Arbet, R. L. Benbow, M. E. Evans, A. A. Mangiaracina, J. L. McGavern, M. C. Spangler, and I. C. Tatum 30 Jul. 1976 64 p refs
(Contract NAS9-14780)
(NASA-CR-147843; MDC-W0018) Avail: NTIS HC $4.50 CSCL 05I

An operational computer program, the Procedures and Performance Program (PPP) which operates in conjunction with the Phase I Shuttle Procedures Simulator to provide a procedures recording and crew/vehicle performance monitoring capability was developed. A technical synopsis of each task resulting in the development of the Procedures and Performance Program is provided. Conclusions and recommendations for action leading to the improvements in production of crew procedures development and crew training support are included. The PPP provides real-time CRT displays and post-run hardcopy output of procedures, difference procedures, performance data, parametric analysis data, and training script/training status data. During post-run, the program is designed to support evaluation through the reconstruction of displays to any point in time. A permanent record of the simulation exercise can be obtained via hardcopy output of the display data and via transfer to the Generalized Documentation Processor (GDP). Reference procedures data may be transferred from the GDP to the PPP. Interface is provided with the all digital trajectory program, the Space Vehicle Dynamics Simulator (SVDS) to support initial procedures timeline development.
Author

N76-29910*# Kanner (Leo) Associates, Annapolis, Md.
MODELING OF INTELLIGENT BEHAVIOR
N. M. Amosov, A. M. Kasatkin, and L. M. Kasatkina Washington NASA Aug. 1976 35 p refs Transl. into ENGLISH from the Russian Preprint-74-2
(Contract NASw-2790)
(NASA-TT-F-17126; Preprint-74-2) Avail: NTIS HC $4.00 CSCL 05J

A brief description is presented of the basic results produced in the course of experimental investigations of the capabilities of one heuristic approach to the problem of construction of models of thinking and intelligent behavior. Operating models of the process of human mental information processing are

represented in the form of network structures with the semantics of M-networks and a specific excitation-inhibition system. Author

N76-29911# Civil Aeromedical Inst., Oklahoma City, Okla.
PHYSIOLOGICAL, SUBJECTIVE, AND PERFORMANCE CORRELATES OF REPORTED BOREDOM AND MONOTONY WHILE PERFORMING A SIMULATED RADAR CONTROL TASK
Richard I. Thackray, J. Powell Bailey, and R. Mark Touchstone Aug. 1975 11 p refs
(AD-A025426/8; FAA-AM-75-8) Avail: NTIS HC $3.50 CSCL 01/2

Several male subjects performed a simulated air traffic control radar task for 1 hour. Subjects were equally divided into three time-of-day groups and tested at 1,000, 1,300, and 1,530. The subject's task was to respond as rapidly as possible to infrequent changes in alphanumeric symbols. Blood pressure, oral temperature, skin conductance, body movement, heart rate and heart-rate variability, and performance measures of mean response latency and variability of response latencies were monitored. In addition, subjects rated their levels of boredom, monotony, irritation, attentiveness, fatigue, and strain at the beginning and end of the session. Two extreme groups of eight subjects each were then formed on the basis of their rated boredom and monotony and compared with respect to changes in each of the measures during the task period. Author

N76-29912# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VISUAL ATTENTION OF PRIVATE PILOTS, THE PROPORTION OF TIME DEVOTED TO OUTSIDE THE COCKPIT Final Report, May 1972 - Mar. 1975
Richard L. Sulzer and Gerald E. Skelton May 1976 25 p refs
(AD-A025468/0; FAA-NA-75-28; FAA-RD-76-80) Avail: NTIS HC $4.00 CSCL 01/2

The direction of the pilot's visual attention was recorded during three series of flights in a small aircraft. It was found that pilots using visual flight rules (VFR) spent approximately 50 percent of the time looking outside the cockpit, an airsearch time much higher than previously recorded for air-carrier cockpits. The remainder of the time, while occupied in the cockpit, the pilot might be likely to miss seeing an approaching aircraft. Hence, a test environment for pilot warning systems intended to aid visual detection of potential threats should employ a pilot workload that produces a realistic proportion of visual attention available for outside search. Author

N76-29913# Naval Training Equipment Center, Orlando, Fla.
THE EFFECT OF DELAY IN THE PRESENTATION OF VISUAL INFORMATION ON PILOT PERFORMANCE Final Report, Apr. 1974 - Jul. 1975
Fred R. Cooper, William T. Harris, and Vincent J. Sharkey Dec. 1975 78 p refs
(NAVTRAEQUIPCEN Proj. 6948)
(AD-A021418; NAVTRAEQUIPC-IH-250) Avail: NTIS CSCL 05/9

The effects of delay in the presentation of visual information on pilot performance during simulated carrier landing tasks were investigated. The TRADEC research flight simulator was used in conjunction with an Evans and Sutherland LDS 1 calligraphic visual display system for several different initial conditions, with and without delayed visual presentation, in conducting evaluations of pilot learning performance and piloting technique. The experimental construction, conduction, data analysis and results are presented. GRA

N76-29914# Human Resources Research Organization, Alexandria, Va.
GROUND OBSERVER ABILITY TO DETECT AND ESTIMATE THE RANGE OF JET AIRCRAFT FLYING OVER HILLY TERRAIN
R. D. Baldwin, E. W. Frederickson, A. L. Kubala, M. R. McCluskey, and A. D. Wright Aug. 1968 100 p refs
(Contract DA-44-188-ARO-2)
(AD-A020657) Avail: NTIS CSCL 15/3

During a series of tests to provide operational and technical data for evaluating the capabilities of surface-based air defense systems against attacks by low-altitude high-performance aircraft, the capabilities of ground observers to detect and estimate the range to aircraft flying attack missions against prebriefed ground targets were examined. Observer performance was obtained for three aircraft flying three programmed speeds and two programmed altitudes. Sixteen observers searched a 180 deg sector for each trial, with early warning of an aircraft approach being provided for some trials. Three real time events--time at detection, time when the aircraft was at the estimated inbound range, and time when aircraft was at the estimated outbound range--were recorded for each observer for each trial. Author (GRA)

N76-29915# National Swedish Inst. for Building Research, Stockholm.
MENTAL AND PERCEPTUAL PERFORMANCE IN HEAT
Curt Johansson 1975 291 p refs
(PB-251439/6; D4:1975; ISBN-91-540-2463-3) Avail: NTIS HC $9.25 CSCL 06S

A review of heat-stress studies suggested that mental, perceptual, and psychomotor tasks have mainly been studied in laboratory experiments performed on heat acclimatized fit young men. The subjects were usually given extensive practice on the performance tasks, which were well learned prior to heat load. The exposure time varied from less than one hour to several hours. The emphasis recently shifted from an exploration of the relation between constant ambient temperature and performance to studies of performance changes under controlled hyperthermia or as a function of ambient temperature swings. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-29916# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
CHEMICALLY GENERATED SUPPLEMENTAL OXYGEN SYSTEMS IN DC-10 AND L-1011 AIRCRAFT Special Study
3 Mar. 1976 46 p refs
(PB-252023/7; NTSB-AAS-76-1) Avail: NTIS HC $4.00 CSCL 01B

The study examines the problems encountered in four recent decompression incidents with respect to the presentation, understanding, and use of chemically generated supplemental oxygen systems installed in DC-10 and L-1011 aircraft. These problems include lack of oxygen flow indications; headband adjustment difficulties; lack of mask stowage methods; unreliability of oxygen compartment doors; method of oxygen mask presentation; flight attendant training; and passenger briefings. The study finds that there is a need for design guidance from the FAA in the design of supplemental oxygen systems as well as a need for proving these systems by actual demonstration. GRA

N76-29917# Illinois Univ., Urbana. Coordinated Science Lab.
TRACKING: AN APPROACH TO DYNAMIC VISION AND HAND-EYE COORDINATION Ph.D. Thesis
V. C. Jones Dec. 1975 76 p refs
(Contract DAAB07-72-C-0259)
(AD-A021674; R696; UILU-ENG-75-2231) Avail: NTIS CSCL 09/2

Many applications for robots require the ability to work with moving objects. The problems encountered due to different types of motion are considered, and a method for providing a robot with real-time vision processing in dynamic environments is presented. By appropriately isolating the tracking task, it is possible to reduce the tracking problem to basic two dimensional pattern verification. Numerous features (potentially moving randomly) can be tracked while planning and recognition functions proceed independently. The tracking ability can also be used to provide a robot with visual feedback in real time for hand-eye coordination. GRA

N76-29918# Army Medical Intelligence and Information Agency, Washington, D.C.
ANTARCTIC CLOTHING
Eduardo Garcia Soto 17 Feb. 1976 6 p Transl. into ENGLISH from Boletin, Instituto Antartico Chileno (Chile), no. 8, 1975 p 26-28
(AD-A021714; USAMIIA-K-6181) Avail: NTIS CSCL 06/17

By the summer of 1972, the Chilean Antarctic institute (INACH, Instituto Antartico Chileno) had carried out exploratory activities in the Antarctic, preferentially in the coastal zones including studies on the food chains of fishes, benthic communities, tide gauging, etc. Starting in 1973, with the definitive organization of the Glaciological Group, investigations began in this scientific discipline and made necessary going further into the continent, therefore confronting a series of new problems of a logistic variety further requiring penetration, supervision, prevention of risks, ranging inward from the coasts, compulsory self-sufficiency, etc. As a consequence of the above, the requirement exists for making adaptations in clothing as well as a number of modifications in equipment used. Recommendations derived from experimentation are presented. GRA

N76-29919# Harry Diamond Labs., Adelphi, Md.
FLUIDIC SENSORS FOR LIFE SUPPORT SYSTEMS
James W. Joyce and Robert L. Woods Oct. 1975 45 p refs (HDL Proj. 379434)
(AD-A022016; HDL-TM-75-17) Avail: NTIS CSCL 06/11

Flueric-bridge sensors have been developed for the Air Force as candidate sensors for measuring gas concentrations and temperatures in life support systems aboard aircraft. Three manifold assemblies -- each containing two flueric concentration sensors and one flueric temperature sensor -- were designed, built, and laboratory tested. In addition, equations describing the theoretical performance of both types of sensors were derived. Measured resistive coefficients for all bridge elements show very little nonideal effects for flows below 3.5 cu cm/sec. For one of the concentration sensors, known mixtures of carbon dioxide in nitrogen were measured; the results were in complete agreement with the theoretical predictions. No temperature-sensing data were gathered in this program. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-29920*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
COORDINATED DESIGN OF CODING AND MODULATION SYSTEMS Semiannual Status Report, 1 Dec. 1975 - 31 May 1976
James L. Massey 17 Aug. 1976 11 p refs
(Grant NsG-5025)
(NASA-CR-148549) Avail: NTIS HC $3.50 CSCL 09B

Work on partial unit memory codes continued; it was shown that for a given virtual state complexity, the maximum free distance over the class of all convolutional codes is achieved within the class of unit memory codes. The effect of phase-lock loop (PLL) tracking error on coding system performance was studied by using the channel cut-off rate as the measure of quality of a modulation system. Optimum modulation signal sets for a non-white Gaussian channel considered an heuristic selection rule based on a water-filling argument. The use of error correcting codes to perform data compression by the technique of syndrome source coding was researched and a weight-and-error-locations scheme was developed that is closely related to LDSC coding. G.G.

N76-29921*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
COMPUTERIZED TOMOGRAPHY USING VIDEO RECORDED FLUOROSCOPIC IMAGES
A. C. Kak, C. V. Jakowatz, Jr., N. A. Baily, and R. A. Keller Jun. 1975 70 p refs
(Grant NGR-05-009-257; Contract F30602-75-C-0150)
(NASA-CR-148596; TR-EE-75-22) Avail: NTIS HC $4.50 CSCL 09B

A computerized tomographic imaging system is examined which employs video-recorded fluoroscopic images as input data. By hooking the video recorder to a digital computer through a suitable interface, such a system permits very rapid construction of tomograms. Author

N76-29922# California Univ., Livermore. Lawrence Livermore Lab.
UNIVAC PARSER
J. S. Chin 2 Oct. 1975 118 p refs
(Contract W-7405-eng-48; ARPA Order 2166)
(UCID-16913) Avail: NTIS HC $5.45

The Research in Secured Operating Systems (RISOS) group of Lawrence Livermore Laboratory conducted a review of the security of the UNIVAC 1100 series Operating System, with specific reference to the modified system at the Naval Command System and Support Activity in Washington. Before conducting a test and evaluation of any particular system, RISOS must be provided with a copy of the system source listings. These listings are then parsed into a number of uniformly formated data bases: parsed data structure and total source listings. This report describes in detail the parser written for the UNIVAC 1100 Series Operating System, and includes a listing of the parser. ERA

N76-29923# Danish Atomic Energy Commission, Risoe.
RISOE HYBRID COMPUTER EAI 680: PDP8/I,FPP12, 2nd EDITION
K. S. Hoejberg Sep. 1975 26 p refs
(RISO-M-1594-ED-2) Avail: ERDA Depository Libraries HC $4.50

The system configuration (EAI 680 analog computer, interface unit, digital computer) and the software system (monitor, compilers, assemblers, assisting programs) are described concisely. Author (ERA)

N76-29924# Kernforschungszentrum, Karlsruhe (West Germany).
CALAS 69/4: A REALTIME OPERATING SYSTEM WITH INTERACTIVE DATA MANIPULATION FOR LABORATORY AUTOMATION AND PROCESS CONTROL
P. Kursawe, K. Rietzschel, and H. Veith Aug. 1975 98 p refs In GERMAN; ENGLISH summary
(KFK-1749) Avail: ERDA Depository Libraries HC $6.00

The hardware and software components of the central laboratory automation system CALAS, consisting of two compatible TR86 computers and process peripherals are discussed. The system described can control up to 28 complex processes. It has been in full operation since 1974, permanently servicing on an average 13 experimental installations in the areas of physics, chemistry, meteorology, and process control. The experimental equipment or process can be managed at a distance of up to 2 km. Peripheral devices are connected to the central processing

system over a special network of fast data transmission lines. A display unit is used to control the equipment and for data manipulation and evaluation as well. Author (ERA)

N76-29925# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
STAGE2 MACROPROCESSOR
Magda Zimanyi 1975 70 p refs In HUNGARIAN; ENGLISH summary
(KFKI-75-56) Avail: ERDA Depository Libraries HC $5.50

A general purpose language-independent macroprocessor (STAGE2), mainly for implementing portable software is described. The macroprocessor, itself a piece of highly portable software, was implemented on the ICL 1905 computer by bootstrapping. This report can serve as a user's manual of STAGE2. Some examples of the application of the processor for language extension, language translation, and text generation are given. Author (ERA)

N76-29926# Sperry Gyroscope Co., Great Neck, N.Y.
DESIGN AND FABRICATION OF RADIATION-HARDENED MNOS MEMORY ARRAY Final Report, 25 Jan. 1973 - 30 Jun. 1974
Paul Marraffino, John M. Rogers, Steven G. Rogich, and H. A. R. Wegener Jul. 1975 205 p refs
(Contract F29601-73-C-0059; DNA Proj. NWED-QAXTD043) (AD-A021421; SGD-4282-0791; AFWL-TR-74-209) Avail: NTIS CSCL 09/2

The report describes work performed to develop a radiation-hardened MNOS memory array for use in a RAM memory of an airborne computer. A study of MNOS device operation led to the fabrication and test of several memory and fixed threshold transistors and 256-bit memory circuits. Environmental test data taken at three radiation simulation sources and under endurance stress is presented along with studies on circuit design, packaging, and system design. GRA

N76-29927# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED MICROCOMPUTER AIRBORNE TACTICAL SYSTEM M.S. Thesis
Tuxaua Plinio Barcelos Linhares Dec. 1975 160 p refs
(AD-A021215) Avail: NTIS CSCL 09/2

An airborne tactical system composed of three distributed microcomputers is described. An extrapolation technique using the method of orthogonal polynomials is presented to solve the ballistics problem. In order to test the performance of distributed microcomputers for real time military applications, a simplified airborne tactical system, using two microcomputers working in parallel, is implemented. The motivation for this research is the reduction of cost that would result from the use of microcomputers in such systems. GRA

N76-29928# Rome Air Development Center, Griffiss AFB, N.Y.
AN ASSOCIATIVE PROCESSOR APPLICATION STUDY Final Report
Michael W. Summers Jan. 1976 46 p refs
(AF Proj. 5550)
(AD-A021232; RADC-TR-75-318) Avail: NTIS CSCL 09/2

This report presents the initial results of an in-house, parallel processor application study. The study was undertaken to evaluate the ability of a parallel computer architecture to perform the data processing functions of the Airborne Warning and Control System (AWACS). The results of the active tracking portion of the study are presented after a brief description of the test problem and the evaluation procedures. GRA

N76-29929# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Jul. - 30 Sep. 1975
Frank E. Heart Oct. 1975 32 p refs
(Contract F08606-75-C-0032; ARPA Order 2351)
(AD-A016614/0; BBN-3182) Avail: NTIS HC $4.00 CSCL 09/2

The ARPA computer network is a packet-switching store-and-forward communications system designed for use by computers and computer terminals. Briefly described are various aspects of network operation and maintenance. A systematic method for detecting and preventing interrupt or multiprogramming bugs is presented in detail. Author (GRA)

N76-29930# Naval Research Lab., Washington, D.C.
TRANSIENT RADIATION TESTS ON THE INTEL 2102 1024-BIT RANDOM ACCESS MEMORY
G. P. Nelson and M. Simmons Dec. 1975 10 p
(AD-A020826; NRL-MR-3187) Avail: NTIS CSCL 09/2

The Intel 2102-1 500-ns RAM is a single monolithic integrated circuit fabricated with N-channel Si-gate technology. The results of transient radiation tests using electron beams from the NRL Linac facility indicate that the device cannot be used in an application where the total dose is greater than 2.0 x 10,000 rad (Si). Further, allowance for a device recovery time of 25 ns should be made if the device is to be exposed to a pulsed radiation environment (60 ns) with an applied dose of between several hundred rads up to approximately 2 x 10,000 rads. Author (GRA)

N76-29931# SCI Systems, Inc., Huntsville, Ala.
DATA HANDLING SYSTEM FOR AEROSPACE RESEARCH FACILITY Final Report, 31 Oct. 1972 - 13 Dec. 1974
Wright-Patterson AFB, Ohio AFAPL Sep. 1975 213 p
(Contract F33615-73-C-2049; AF Proj. 3145)
(AD-A021970; AFAPL-TR-75-61) Avail: NTIS CSCL 09/2

The objective of this program is to build an electrical multiplexing system to the specifications established by the SAE-A2-K and the ASD Multiplexing Standardization Committees. Author (GRA)

N76-29932# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH DENSITY OPTICAL MEMORY Final Technical Report
H. W. Knoebel, H. V. Krone, B. D. Kirkwood, J. V. Burt, and D. G. Harris Nov. 1975 107 p refs
(Contract N00014-67-A-0305-0015)
(AD-A021673) Avail: NTIS CSCL 09/2

The purpose of this research is to study the problems associated with an experimental read-write, random access optical memory and to demonstrate its feasibility. The memory element employed is the (M sub A) color center in KCl:NaCl. The fact that it is extremely well studied and that the writing wavelength is in the visible range determined its choice for this study. Topics discussed in the report include the following: Color center physics; Diffraction limited focusing and heating effects; Crystal preparation; Thermo electric cooling; Polarization control; Deflection systems; Memory controller; Computer interface; Experimental results. GRA

N76-29933# Naval Postgraduate School, Monterey, Calif.
DESIGN CONSIDERATIONS FOR THE NPS SIGNAL PROCESSING AND DISPLAY LABORATORY MULTIPROCESSING OPERATING SYSTEM
B. E. Allen and G. L. Barksdale, Jr. Nov. 1975 25 p refs
(AD-A021828; NPS-72An75111) Avail: NTIS CSCL 09/2

The design and implementation of MUNIX, a tightly-coupled symmetric multiprocessing PDP 11 based operating system providing real-time, interactive, and background processing facilities in a hierarchical memory environment is described. MUNIX is a variant of UNIX, an operating system for the PDP 11 developed at Bell Laboratories. The three major design goals of the system were: (1) support for processes capable of real-time interaction with several dynamic graphics display units, an array processor, and a multi-channel A/D converter; (2) interactive and background processing facilities to support program development; and, (3) management of the hierarchical storage created by the mix of shared and private memories of various speeds. GRA

N76-29934# Illinois Univ., Urbana. Coordinated Science Lab.
COMPUTER UNDERSTANDING OF DESIGN Ph.D. Thesis
Tony Cheng-Hsiang Woo Oct. 1975 145 p refs
(Contract DAAB07-72-C-0259)
(AD-A021784; R-695; UILU-ENG-75-2230) Avail: NTIS CSCL 09/2

This work integrates the design and manufacturing processes by interfacing computer graphics to numerical control. It focuses on the transformation of geometric descriptions of three

dimensional machine part into procedural descriptions of tooling operations. Three dimensional machine parts are designed with volume building blocks. The blocks are converted into programs. The interaction among the volume building blocks is expressed as the interaction among programs--which results in a cavity description of the machine part. The cavity description is next interpreted based on a volume oriented model of a three-axis drilling/milling machine. Type of cuts and tool paths are generated in the form of numerical control program. GRA

N76-29935# National Bureau of Standards, Washington, D.C.
A CONTRIBUTION TO COMPUTER TYPESETTING TECHNIQUES: TABLES OF COORDINATES FOR HERSHEY'S REPERTORY OF OCCIDENTAL TYPE FONTS AND GRAPHIC SYMBOLS Special Publication
Norman M. Wolcott Apr. 1976 176 p refs
(PB-251845/4; NBS-SP-424; LC-75-619219) Avail: NTIS HC $7.50 CSCL 09B

These tables present coordinates from which it is possible to generate 1,377 different alphabetic and graphic characters on either COM devices or on digital plotters. The tables, originally developed by Dr. A. V. Hershey of the Naval Weapons Laboratory, are augmented by corresponding figures which show for each character the location of the tabulated points and the manner in which they are connected. The tables can be used with existing typographic systems to compose pages for scientific and mathematical publications of graphic arts quality either on COM devices or flat-bed plotters. Numerous applications are discussed and illustrated. GRA

N76-29936# Mathematics and Computation Lab., Washington, D. C. Time-Sharing Systems Div.
THE 1108 SORT/MERGE PROCESSORS Final Report
William H. Morrison Mar. 1976 53 p Revised
(PB-251732/4; GSA/FPA/MCL-TM-218-Rev-1) Avail: NTIS HC $4.50 CSCL 09B

The software described is to facilitate sorts on data and subsequent merges of tapes by the users in the Mathematics and Computation Laboratory. The purpose of the Sort Package is to provide the user with the simplest and most efficient method of sorting large volumes of data. This is accomplished through the use of a small and very concise set of card images. These card images require the user to define the formats and media of the input file and output file, and to define the keys to be used for sorting. GRA

N76-29937# Mathematics and Computation Lab., Washington, D. C. Time-Sharing Systems Div.
INPUT-OUTPUT INTERFACE FOR FORTRAN 5 UNDER THE UNIVAC 1100 SERIES OPERATING SYSTEM Final Report
Robert K. Fetter Aug. 1975 38 p Revised
(PB-251734/0; GSA/FPA/MCL-TM-254-Rev-1) Avail: NTIS HC $4.00 CSCL 09B

The main purpose of this system is to provide MCL programmers and any Federal Preparedness Agency (FPA) customer with the capability of handling nonstandard data at the item level as well as the block level through FORTRAN 5 on the 1108 computer. This package interfaces FORTRAN 5 and the Univac 1100 Series Operating System data handling routines, the item handler, and the block buffering package, and provides FORTRAN 5 programs a linkage to the Univac 1100 Series Operating System Data Handling and ASSEMBLY language routines. Other features available are; automatic file labeling, block numbering, check summing, random processing, exclusive reading of items, etc. GRA

N76-29938# Mitre Corp., Bedford, Mass.
FAILURE STUDY AND RELIABILITY CONSIDERATIONS FOR RTE DESIGN VERIFICATION MODELS
M. Ferdman Feb. 1976 61 p
(Contract F19628-76-C-0001; AF Proj. 572D)
(AD-A021666; MTR-3094; ESD-TR-75-366) Avail: NTIS CSCL 09/2

The Remote Terminal Emulator is a minicomputer-based system which generates message traffic for use in testing and evaluating large-scale, multi-terminal systems. Throughout the development of two design verification models of the RTE, which used a Data General NOVA 800 and associated peripheral equipment, there appeared to be an abnormal amount of down time due to various hardware failures. This report reviews those failures and compares the actual results with a theoretical reliability model for the NOVA 800. It determines that the failure rates were not abnormally high for this class of equipment in the operating environment to which they were subjected, and develops recommendations to systems in the future. Author (GRA)

N76-29939# Massachusetts Inst. of Tech., Cambridge.
EARLY PROCESSING OF VISUAL INFORMATION
David Marr Dec. 1975 69 p refs Supersedes AI-M-324 and A-IM-334
(Contract N00014-75-C-0643)
(AD-A021445; AI-M-340; AI-M-324; AI-M-334) Avail: NTIS CSCL 09/2

The article describes a symbolic approach to visual information processing, and set out four principles that appear to govern the design of complex symbolic information processing systems. A computational theory of early visual information is presented, which extends to about the level of figure-ground separation. It includes a process-oriented theory of texture vision. Most of the theory has been implemented, and examples are shown of the analysis of several natural images. This replaces AIM-324 and AIM 334. GRA

N76-29940# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DISTRIBUTED COMPUTATION AND TENEX-RELATED ACTIVITIES Quarterly Progress Report, 1 Nov. 1975 - 30 Jan. 1976
J. Burchfiel, R. Thomas, T. Myer, and R. Tomlinson Feb. 1976 29 p refs
(Contract N00014-75-C-0773; ARPA Order 2901; ARPA Order 2935)
(AD-A022380; BBN-3257; QPR-5) Avail: NTIS CSCL 09/2

This report describes BBN efforts in the design of the National Software Works system and BBN efforts to integrate TENEX into the National Software Works System. It also describes BBN efforts to upgrade existing ARPANET message service to meet Navy requirements for an interactive message processing test at CINCPAC. Author (GRA)

N76-29941# Bendix Corp., Teterboro, N.J. Flight Systems Div.
DESIGN OF DIGITAL AIR DATA COMPUTERS Final Report, May 1970 - Sep. 1975
Joseph L. Ascolese, Casmir S. Smialowicz, and Robert Atlas Sep. 1975 250 p
(Contract F33657-70-C-1126; AF Proj. 2713)
(AD-A021510; ASD-TR-75-30) Avail: NTIS CSCL 09/2

This report presents the design approach for subsystems implemented in solid-state digital Air Data Computers to fit high accuracy and high speed needs of high performance aircraft. In addition, the design data provides direction for design specification of future solid-state digital Air Data Computers. A trade off of various techniques such as solid state analog, hybrid and digital mechanization utilizing current and latest state of the art approaches are discussed. The characteristics of the necessary design parameters to achieve total system accuracy and response requirements has an enormous variety of meanings therefore a proposed specification checklist is presented to minimize the complexity of equipment and to insure that all pertinent areas are realistically specified. Author (GRA)

N76-29942# Army Electronics Command, Fort Monmouth, N.J.
THE INTERACTIVE COMPUTER NETWORK GRAPHICS SYSTEM Final Report
Courtenay B. Clifford Mar. 1976 18 p refs
(AD-A022022; ECOM-4393) Avail: NTIS CSCL 09/2

The Interactive Computer Network Graphics System is a minicomputer based project control network information system using interactive graphics techniques. The system was developed to prove the feasibility of developing a program that displays images of PERT Networks from an existing data base and then allows editing of that data base. The system has the capability to edit the data base and perform PERT-like analysis of the results giving the user feedback about the effect of his changes. Full size plots of the network can be produced. This report

described the changes and improvements made in the Phase II development effort. Author (GRA)

N76-29943# RAND Corp., Santa Monica, Calif.
RAND INTELLIGENT TERMINAL AGENT (RITA): DESIGN PHILOSOPHY
R. H. Anderson Feb. 1976 61 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A022053; R-1809-ARPA) Avail: NTIS CSCL 09/2

The report presents a description of the design constraints, design requirements, and overall design philosophy guiding the implementation of the RAND Intelligent Terminal Agent (RITA). RITA is a set of computer programs residing in a PDP-11/45 minicomputer. These programs are capable of acting as a 'user agent' which can perform a variety of tasks, under either direct user control or semiautonomous operation over extended periods of time. The RITA system is designed to be widely applicable as a stand-alone computing resource for local text manipulation, as a limited heuristic modeling tool, and as a front end to remote computing systems and networks. Operational features in the current (January 1976) version of RITA are described. GRA

N76-29326* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIPLEX, PIPELINED FFT
R. F. Emerson *In its* The Deep Space Network 15 Aug. 1976 p 54-59 ref (For availability see N76-29318 20-12)
CSCL 09B

N76-29328* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN STANDARD INTERFACE ADAPTER AND BUFFER ASSEMBLY USED IN THE MARK 3 DATA SYSTEM
T. Anderson *In its* The Deep Space Network 15 Aug. 1976 p 75-83 (For availability see N76-29318 20-12)
CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-29944 California Univ., Berkeley.
INFINITE NORMAL FORMS FOR THE LAMBDA-CALCULUS AND SEMANTICS OF PROGRAMMING LANGUAGES Ph.D. Thesis
Reiji Nakajima 1975 147 p
Avail: Univ. Microfilms Order No. 76-15320

The semantics of programming languages is studied through the notion of infinite expansions of programs. This idea is formalized on the domain of the Lambda-calculus. A mapping is defined from the Lambda-expressions to an algebraic domain, called C-function. The map of a Lambda-expression (program) by the C-function is the infinite expansion of the Lambda-expression which can be said to be a generalization of the normal forms for the Lambda-calculus. Bohm's Theorem on the normal Lambda-expression is extended to general lambda-expressions via the C-function. Dissert. Abstr.

N76-29945*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A METHODOLOGY FOR PRODUCING RELIABLE SOFTWARE, VOLUME 1 Final Report
Leon G. Stucki, Paul B. Moranda, Gary Foshee, Marjorie Kirchoff, and Roger Omre Mar. 1976 228 p refs
(Contract NAS5-20781)
(NASA-CR-144769; MDC-G6210-Vol-1) Avail: NTIS HC $8.00 CSCL 09B

An investigation into the areas having an impact on producing reliable software including automated verification tools, software modeling, testing techniques, structured programming, and management techniques is presented. This final report contains the results of this investigation, analysis of each technique, and the definition of a methodology for producing reliable software. Author

N76-29946*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A METHODOLOGY FOR PRODUCING RELIABLE SOFTWARE, VOLUME 2 Final Report
Leon G. Stucki, Paul B. Moranda, Gary Foshee, Marjorie Kirchoff, and Roger Omre Mar. 1976 339 p
(Contract NAS5-20781)
(NASA-CR-144770; MDC-G6210-Vol-2) Avail: NTIS HC $10.00 CSCL 09B

For abstract, see Vol. 1.

N76-29947# California Univ., Livermore. Lawrence Livermore Lab.
STAR BASIC MATHEMATICAL SUBROUTINES
R. E. VonHoldt 18 Dec. 1975 38 p
(Contract W-7405-eng-48)
(UCID-30123) Avail: NTIS HC $4.00

The following mathematical subroutines are described: FEXP (Full-Word Exponential Function), HEXP (Half-Word Exponential Function), FLOG (Full-Word Logarithm Function), HLOG (Half-Word Logarithm Function), FE21 (Full-Word Cos-Sin Function), HE21 (Half-Word Cos-Sin Function), FR2P (Full-Word Rectangular-to-Polar Transformation Function), HR2P (Half-Word Rectangular-to-Polar Transformation Function), FSAT (Full-Word Arctangent Function), and HSAT (Half-Word Arctangent Function). Assembly language listings are provided for those beginning with F. Author (ERA)

N76-29948# California Univ., Livermore. Lawrence Livermore Lab.
LIVERMORE TIME-SHARING SYSTEM. PART 3: PROBLEM PROGRAM PRODUCTION. CHAPTER 209: LLL-APL USER'S MANUAL
C. A. Wilgus, R. G. Zwakenberg, and N. T. Dairiki 19 Feb. 1975 177 p Supersedes UCID-30026
(LTSS-209-ED-1-Pt-3; UCID-30026) Avail: NTIS HC $8.50

APL language functions are defined and then illustrated in examples. In addition to the basic primitive and mixed language functions, user-defined functions, system commands, and I-beam functions are covered, as well as unique features of LLL APL that include the reading and writing of files. Both LLL-APL keyboard symbols and standard APL keyboard symbols are presented. The intent is to give the reader a working knowledge of the APL interpretive operating system at LLL and to permit him to make the transition readily to a standard APL keyboard when necessary. Author (ERA)

N76-29949# Centro Informazioni Studi Esperienze, Milan (Italy).
COMPUTATIONAL EXPERIENCE WITH QUASI-NEWTON ALGORITHMS FOR MINIMIZATION PROBLEMS OF MODERATELY LARGE SIZE
E. Spedicato Oct. 1975 38 p refs
(CISE-N-175) Avail: ERDA Depository Libraries HC $4.00

Quasi-Newton algorithms, known as the BFS and the OS method, for the unconstrained minimization of nonlinear functions are compared on a set of significant problems up to 80 variables. It is shown that, when the minimization is started with the unit matrix, the performance of the BFS deteriorates with growing n more rapidly than the performance of the OS. A way to scale the initial matrix in some cases is also suggested; this results in greatly improving the performance of the BFS, which becomes competitive with the OS even for large problems. Author (ERA)

N76-29950# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
PROCESS BASIC
F. Wagner and H. Woda Aug. 1975 162 p refs In GERMAN; ENGLISH summary
(KFK-PDV-53) Avail: ERDA Depository Libraries HC $6.75

The PROCESS BASIC is a programming system for process control and scientific applications by means of a mini-computer. The PROCESS BASIC language consists of the high-level programming language BASIC, a powerful macro-assembly language, and the machine code of the computer used. These three language levels can be mixed line by line. Formated input/output statements and statements for interrupt handling and real-time programming are available. Any process peripherals can be connected to the system easily via a simple software

interface. The complete system consists of a one-pass-translator, a loader, a linkage-editor, and a newly developed operating system using 8K (20 bits) of working storage. PROCESS BASIC was implemented on a UNICOMP 201 computer. Author (ERA)

N76-29951# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
METHOD FOR PERFORMANCE COMPARISON OF ddc ALGORITHMS AND APPLICATION OF THIS METHOD TO SELECTED CASES BY MEANS OF THE COMPUTER PROGRAM OPTAL
W. Patzelt and M. Salaba Jul. 1975 69 p refs In GERMAN (KFK-PDV-47) Avail: ERDA Depository Libraries HC $4.50

Characteristics and test setups are defined for the comparison of direct digital control algorithms for single variable control. Under the test setup process, process controller, signal, the control algorithms to be compared are characterized by the characteristics quality measure, sensitivity measure, costs. The defined characteristics under the defined test setups are investigated for four types of algorithms designed with respect to deadbeat response, minimal integrated squared error, quantity optimum (PID structure), quantity optimum with compensation of dead time by the process model (PID structure). A digital computer program 'OPTAL' for design and simulation of direct digital control is used. Author (ERA)

N76-29952# Kernforschungszentrum, Karlsruhe (West Germany).
DEFINITION, TRANSLATION, AND APPLICATION OF USER-ORIENTED LANGUAGES AS EXTENSIONS OF PL/1 IN THE CAD-SYSTEM REGENT
G. Enderle Sep. 1975 162 p refs In GERMAN; ENGLISH summary
(KFK-2204) Avail: NTIS HC $7.75

The integrated CAD-system REGENT serves for modular development of programs for different application areas, for management of data storage and data transfer, and easy and safe application of programs by means of user-oriented languages. Programs data, and language for an application area form a REGENT subsystem. The problem language system of REGENT, PLS (Problem Language Systems), provides facilities for the development of a problem-oriented language for every subsystem as extensions of the base language PL/1. The translation of problem oriented languages by a precompiler into PL/1 and the definition of language extensions and data structures for subsystems are described. Development and application of the language for a fluid-dynamic subsystem are shown.
Author (ERA)

N76-29953# California Univ., Los Angeles. Dept. of Computer Science.
A TEXT UNDERSTANDING PROGRAM FOR MODIFYING FACIAL LINE DRAWINGS ON A CRT Interim Report
Michael L. Rhodes Oct. 1975 81 p refs
(Grant AF-AFOSR-2384-72; AF Proj. 9769)
(AD-A020753; UCLA-ENG-7581; AFOSR-76-0123TR) Avail: NTIS CSCL 09/2

This report describes a cooperative interaction between human recognition and descriptive powers and a text understanding program for generating facial images. Language design and implementation techniques of the developing program are discussed with special attention to requirements for conversational communication. Excerpts from an example dialogue demonstrate resolution of relational ambiguities and maintenance of contextual information by the interactive program. All processing is done in an IMLAC PDS-1 minicomputer and display processor of 8K 16 bit/word memory. Author (GRA)

N76-29954# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES, VOLUME 13 Final Technical Report
John J. Naughton and Ronald L. Smith 15 Jul. 1975 74 p ref Sponsored in part by Army 15 Vol.
(Contract F30602-74-C-0186)
(AD-A020858; RADC-TR-74-300-Vol-13) Avail: NTIS CSCL 09/2

This volume summarizes the tasks and products resulting from the structured programming studies performed under contract. It contains contract conclusions and recommendations. It also contains scope of work, task activities and results for each of the fourteen tasks. The report also relates structured programming technology to the phases of the software development cycle. GRA

N76-29955# Naval Research Lab., Washington, D.C.
A FORTRAN SUBROUTINE TO EVALUATE STRUVE FUNCTIONS FOR INTEGER ORDERS AND POSITIVE REAL ARGUMENTS Interim Report
Janet P. Mason Dec. 1975 20 p
(AD-A020828; NRL-MR-3181; NRL-Computer-Bull-43) Avail: NTIS CSCL 09/2

A subroutine which generates a table of Struve functions H sub n(X) for all positive integer orders from zero up to and including a given order n, for a given positive argument x, has been written in FORTRAN for the CDC 3600/3800. This report describes the subroutine and its use. A source language listing and a test program and its results are included. GRA

N76-29956# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PLOTTING SOFTWARE FOR THE ILLUSTROMAT-RECORDAMAT SYSTEM Final Report
Morton A. Hirschberg and Bernard Soroka Feb. 1976 126 p
(AD-A021640; BRL-1854) Avail: NTIS CSCL 09/2

The Illustromat-Recordamat plotting system forms a complete graphics system. The machines may be used as a digitizer, accepting two or more views of a blueprint, or data on a magnetic tape. As no software existed to prepare magnetic tape input, it became attractive to design a Cal-Comp-like library of subroutines to fulfill this function. Besides greatly expanding the system's capability, compatibility with other government agencies, and/or contractors having access to Cal-Comp software was achieved. The Illustromat plotter is an analog machine with a .005 inch resolution. Combined with the Recordamat 1250-2 mini computer (a 16 bit machine with 8192 words of memory built by Lockheed Electronics) the plotter may be directed to move to a point, draw straight lines, draw circles, and draw general curved lines (using cubic interpolation). Data generated by the routines described in this report drives the plotting system. Driving data is stored as 7 bit NRZI code at a density of 556 bits per inch. Limitations of the hardware and suggested solutions are described. Use of formatted data of two views of an object to reconstruct its three-dimensional representation is a desired goal for the future. Author (GRA)

N76-29957# Defense Communications Engineering Center, Reston, Va.
A UNIFIED APPROACH TO MODELLING LOOP SERVICE SYSTEMS: A PRELIMINARY REPORT
M. Fischer Dec. 1975 21 p refs
(AD-A021940; TN-41-75) Avail: NTIS CSCL 09/2

Loop service systems are used as a model to predict the performance of such telecommunication systems as multidrop lines, concentrators and various satellites systems. Available results for different configurations are often based on different assumptions and so direct comparisons can not be made. This report presents a unified method of analyzing such congestion systems. GRA

N76-29958# Carnegie-Mellon Univ., Pittsburgh, Pa.
ALGORITHMS FOR SOLVENTS OF MATRIX POLYNOMIALS Interim Report
J. F. Traub, J. E. Dennis, Jr. (Cornell Univ.), and R. P. Weber (Bell Laboratories) Oct. 1975 26 p refs
(Contract N00014-67-A-0314-0010)
(AD-A020209) Avail: NTIS CSCL 12/1

In an earlier paper the authors developed the algebraic theory of matrix polynomials. Here they introduce two algorithms for computing 'dominant' solvents. Global convergence of the algorithms under certain conditions is established. GRA

N76-29959# Naval Air Development Center, Warminster, Pa. Systems Analysis and Engineering Dept.
IMPROVED SOFTWARE PRODUCTIVITY FOR MILITARY COMPUTER SYSTEMS THROUGH STRUCTURED PROGRAMMING
Richard J. Pariseau 12 Mar. 1976 87 p refs

(AD-A022284; NADC-76044-50) Avail: NTIS CSCL 09/2

High productivity and good quality software have been achieved in a military systems development through the use of structured programming techniques. These techniques include the software engineering team, egoless programming, top down implementation, structured coding, and use of a hosted emulator in place of the target computer. GRA

N76-29960# Stanford Research Inst., Menlo Park, Calif.
REMOVING TRIVIAL ASSIGNMENTS FROM PROGRAMS
B. Mont-Reynaud Mar. 1976 31 p refs
(Contract N00014-75-C-0816; NSF MCS-72-03752-A03; NR Proj. 049-378)
(AD-A021572; SRI-4079-TR-1) Avail: NTIS CSCL 09/2

An assignment Y to X in a program is 'trivial' when both X and Y are simple program variables. The paper describes a transformation which removes all such assignments from a program P, producing a program P' which executes faster than P but usually has a larger size. The number of variables used by P' is also minimized. Worst-case analysis of the transformation algorithm leads to nonpolynomial bounds. Such inefficiency, however, does not arise in typical situations, and the technique appears to be of interest for practical compiler optimization. GRA

N76-29961# Stanford Research Inst., Menlo Park, Calif.
AN EXAMPLE OF HIERARCHICAL DESIGN AND PROOF
J. M. Spitzen, Karl N. Levitt, and Lawrence Robinson Mar. 1976 28 p refs
(Contracts N00014-75-C0816; F44620-73-C-0068; Grant NSF DCR-74-18661; NR Proj. 049-378)
(AD-A021574; SRI-4079-TR-2) Avail: NTIS CSCL 09/2

Hierarchical programming is being increasingly recognized as helpful in the construction of large programs. Users of hierarchical techniques claim or predict substantial increases in productivity and in the reliability of the programs produced. In this paper the authors describe a formal method for hierarchical program specification, implementation, and proof. The authors apply this method to a significant list processing problem and also discuss a number of extensions to current programming languages that ease hierarchical program design and proof. GRA

N76-29962# Washington Univ., Seattle. Dept. of Mathematics.
A LINEAR MATCHING ALGORITHM FOR ACYCLIC GRAPHS
Victor Klee Feb. 1976 16 p refs
(Contracts N00014-67-A-0103-0003; N00014-76-C-0423; NR Proj. 044-353)
(AD-A022326; TR-57) Avail: NTIS CSCL 12/2

When G is a graph of (V,E), and Y a subset of V, the Y-value of a matching M subset of E is defined as 2 absolute value M + approximately joint sum of Y and M. The problem of finding a matching of maximum Y-value is reduced by an algorithm of time- and space-complexity to a similar problem in the graph obtained from G by successive deletions of vertices of valence less than or equal to 1. When G is acyclic, the original problem is solved completely in time and space. GRA

N76-29963# Stanford Univ., Calif.
A FINITE ALGORITHM FOR THE LINEAR EXCHANGE MODEL
B. Curtis Eaves Feb. 1975 12 p refs
(Contract DAHC04-74-C-0032; Grant NSF GP-34559; ARO Proj. P-12396-M)
(AD-A020340; SU-SOL-75-4; ARO-12396.2-M) Avail: NTIS CSCL 12/1

It is shown that Lemke's algorithm can be used to compute, in a finite number of steps, an equilibrium or a reduction for the pure exchange model with linear utilities. Author (GRA)

N76-29964# Wisconsin Univ., Madison. Mathematics Research Center.
INTE: A UNIVAC 1108/1110 PROGRAM FOR NUMERICAL INTEGRATION WITH RIGOROUS ERROR ESTIMATION Technical Summary Report
Julia H. Gray and L. B. Rall Oct. 1975 64 p refs
(Contract DAAG29-75-C-0024; Grant NSF GP-40381)
(AD-A020197; MRC-TSR-1428) Avail: NTIS CSCL 12/1

By use of the concepts of interval analysis, one can construct methods for numerical integration which give rigorous bounds on errors due to imprecise data, round-off, and truncation, and also make possible the detection of the use of incorrect formulas. On the basis of parameters obtained from interval integration formulas, the calculation of numerical integrals can be optimized with respect to time and accuracy. Improved error bounds can also be obtained in certain cases by intersection of interval results. This paper describes a computational system of interval type which has been implemented as a computer program for the UNIVAC 1108/1110, using software previously developed at MRC for interval analysis and automatic differentiation. The program accepts integrands which are functions of a single variable, written as one or more ordinary FORTRAN statements. In addition to the variable of integration, these statements may include one or more parameters to be specified by the user, and the program may be used in interactive or batch mode. GRA

N76-29965# RAND Corp., Santa Monica, Calif.
THOUGHTS ON ESTABLISHING GUIDELINES AND RATIONALE FOR WORKSHOP OUTPUT
M. R. Davis Jan. 1975 6 p
(AD-A021711; P-5523) Avail: NTIS CSCL 09/2

A simple extrapolation of past trends suggests a considerable future expansion of the use of computers in the Department of Defense, both in military systems and in base and support operations. Any R and D program to increase software reliability must recognize this dynamic nature of the software problem and be directed at levels of complexity anticipated five years (plus) into the future. It must also recognize that software exists across all services and that solutions should be directed simultaneously at Tri-Service problems. A necessary first step in formulating programs to achieve software reliability is to have a clear understanding of what the fundamental current and anticipated problems are. They certainly run the gamut from organizational structure and software management techniques to software technology and are sometimes difficult to distinguish from symptoms. GRA

N76-29966# National Science Foundation, Washington, D.C. Div. of Computer Research.
COMPUTER ELEMENTS AND SYSTEMS
N. G. Zagoruiko Jan. 1975 165 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), v. 45, 1971 165 p
(TT-72-58027) Avail: NTIS HC $6.25 CSCL 09D

Computer programming for signal processing is discussed. Taxonomy programs; random search with adaptation programs; and spectral analysis programs are reviewed. GRA

N76-29967# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ANALYSIS OF DEADLOCK AVOIDANCE SCHEMES AND RESOURCE UTILIZATION FOR NON-PREEMPTIBLE RESOURCES
Hsiau-Chung Chang 20 Jun. 1975 235 p refs
(Contract F44620-73-C-0074)
(AD-A021732; AFOSR-75-1674TR) Avail: NTIS CSCL 09/2

Two aspects of the performance of deadlock avoidance schemes are studied. The first is the cost of deadlock avoidance algorithms. This represents the system overhead. The second is the resource utilization under different schemes. For the first, the basic cost is the computation of the Boolean function safe(I), where I is an integer vector representing the system state. SAFE(I) is true if the system is safe, false otherwise. The resource allocator will make the allocation only when the resulting system has safe(I) = true. Based on the concept of computation trees, several lower bounds for the cost involved in computing safe(I) are established under different conditions. An upper bound is also developed. GRA

N76-29968# Mathematics and Computation Lab., Washington, D. C. Applied Economics Div.
NEWECL: ECONOMIC COMPUTER LANGUAGE DATA HANDLERS Final Report
Rod L. Renner Sep. 1975 60 p
(PB-251733/2; GSA/FPA/MCL-TM-250) Avail: NTIS

HC $4.50 CSCL 09B

In the dynamic environment of an organization in which diverse economic applications programs must share common economic data, the need to establish a common economic data format and method of accessing and storing economic data is evident. This need has been satisfied with the development of the Economic Computer Language (NEWECL) Data Handlers, a package of UNIVAC 1108 subroutines and programs. Descriptions, calling sequences, and examples of the use of the four NEWECL Data Handler parts are presented. Author (GRA)

N76-29969# Maryland Univ., College Park. Computer Science Center.
FURTHER PROGRAMS FOR THE SOLUTION OF LARGE SPARSE SYSTEMS OF LINEAR EQUATIONS
Charles K. Mesztenyi and Werner C. Rheinboldt Aug. 1975 51 p refs
(Contract N00014-67-A-0239-0021; Grant NSF GJ-35568; NR Proj. 044-431)
(AD-A021668; TR-394) Avail: NTIS CSCL 09/2

A package of FORTRAN subroutines is presented for the solution of non-symmetric or symmetric sparse linear systems by triangular decomposition. Two principle aims are (1) to handle matrices which originally fit into primary core storage but do so no longer after decomposition, and (2) to solve a sequence of linear systems all of which have the same sparsity structure by generating--in secondary storage--a record of the decomposition process in the form of an integer array. Some experimental results using the package are included. Author (GRA)

N76-29970# General Research Corp., Santa Barbara, Calif.
JOVIAL AUTOMATED VERIFICATION SYSTEM (JAVS) Final Technical Report, Jul. 1973 - Nov. 1975
N. B. Brooks, E. F. Miller, Jr., and W. R. Wisehart Griffiss AFB, N. Y. RADC Feb. 1976 92 p refs
(Contract F30602-73-C-0344; AF Proj. 5581)
(AD-A022056; CR-4-465; RADC-TR-76-20) Avail: NTIS CSCL 09/2

This report describes the implementation and application of a methodology for systematically and comprehensively testing computing software. The methodology uses the structure of the software undergoing test as the basis for analysis by an automated verification system (AVS). The AVS itself is a series of tools which provide a means of measuring the effectiveness of both individual and cumulative software test cases, a capability to facilitate the construction of test data that will thoroughly exercise the software, and an analysis of retesting requirements following software modification. The AVS has been implemented for the analysis of computer software written in the JOVIAL J3 language and is operational on both the HIS-635 computer at Rome Air Development Center (RADC) in Rome, New York, and the CDC 6400 computer at General Research Corporation in Santa Barbara, California, where it was developed. This JOVIAL Automated Verification System (JAVS) has been subjected to extensive installation testing including a self-analysis test series which resulted in over 85% coverage of all executable statements in the JAVS source program. GRA

N76-29971# University of Southern Calif., Marina del Rey. Information Sciences Inst.
DATA DEPENDENCY ANALYSIS
Richard Bisbey, II, Jim Carlstedt, Dale Chase, and Dennis Hollingworth Feb. 1976 27 p refs
(Contract DAHC15-72-C-0308)
(AD-A022017; ISI/RR-76-45) Avail: NTIS CSCL 09/2

In order to understand the structure of computer programs and to detect certain types of protection errors in computer operating systems, it is often necessary to determine the flow of data both within single programs and among programs. The report describes a simple technique, data dependency analysis, for automatically generating this information from the static source representation of programs. The report also describes an experimental implementation used to determine the data flow of PL/1 programs taken from the Multics operating system. Author (GRA)

N76-29972# Stanford Research Inst., Menlo Park, Calif.
A FAST STRING SEARCHING ALGORITHM
Robert S. Boyer and J. Strother Moore Mar. 1976 41 p refs
(Contract N00014-75-C-0816; NR Proj. 049-378; SRI Proj. 4079)
(AD-A022028; TR-3) Avail: NTIS CSCL 12/1

An algorithm is presented that searches for the location, i, of the first occurrence of a character string, pat, in another string, string. During the search operation, the characters of pat are matched starting with the last character of pat. The information gained by starting the match at the end of the pattern often allows the algorithm to proceed in large jumps through the text being searched. Thus, the algorithm has the unusual property that, in most cases, not all of the first i characters of string are inspected. The number of characters actually inspected (on the average) decreases as a function of the length of pat. For a random English pattern of length 5, the algorithm will typically inspect i/4 characters of string before finding a match at i. Furthermore, the algorithm has been implemented so that (on the average) fewer than i - patlen machine instructions are executed. These conclusions are supported with empirical evidence and a theoretical analysis of the average behavior of the algorithm. The worst case behavior of the algorithm is linear in i - patlen. Author (GRA)

N76-29324* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DECODING WITH MULTIPLIERS
L. D. Baumert, R. J. McEliece, and G. Solomon (UCLA) *In its* The Deep Space Network 15 Aug. 1976 p 43-46 refs (For availability see N76-29318 20-12)
CSCL 09B

N76-29325* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODC2 PROCEDURES FOR ASSEMBLY OF MODCOMP-2 PROGRAMS USING THE SIGMA 5 ASSEMBLER
J. W. Layland *In its* The Deep Space Network 15 Aug. 1976 p 47-53 refs (For availability see N76-29318 20-12)
CSCL 09B

N76-29329* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW SEQUENTIAL DECODER FOR THE DSN TELEMETRY SUBSYSTEM
J. H. Wilcher *In its* The Deep Space Network 15 Aug. 1976 p 84-87 (For availability see N76-29318 20-12)
CSCL 09B

N76-29330* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA POINTING SUBSYSTEM CONSCAN IMPLEMENTATION
R. Tappan *In its* The Deep Space Network 15 Aug. 1976 p 88-89 (For availability see N76-29318 20-12)
CSCL 09B

N76-29332* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN MBASIC APPLICATION PROGRAM FOR RELATIONAL INQUIRIES ON A DATA BASE
R. M. Smith *In its* The Deep Space Network 15 Aug. 1976 p 100-107 refs (For availability see N76-29318 20-12)
CSCL 09B

N76-29333* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODING (MCD) PERFORMANCE DUE TO SYSTEM LOSSES
L. Webster *In its* The Deep Space Network 15 Aug. 1976 p 108-118 refs (For availability see N76-29318 20-12)
CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N76-29973# New York Univ., N.Y. Div. of Applied Science.
COMPUTER RECONSTRUCTION OF QUADRIC-SURFACED OBJECT FROM TWO OR MORE VISIBLE-LINE PROJECTIONS Interim Report
Ruth Shapira Aug. 1975 51 p refs
(Grant AF-AFOSR-2755-75; AF Proj. 9769)
(AD-A020628; CRL-44; AFOSR-76-0047TR) Avail: NTIS CSCL 09/2

One of the key problems in the interaction between computers and the real world is scene analysis - the computer interpretation of photographic images of physical objects. This problem is also referred to as the reconstruction problem. This report deals with scenes composed of objects bounded by quadric surfaces. The visual information in the photographic image, extracted in the form of a matrix of quantized grey levels, is assumed to have been reduced to a line structure by an appropriate preprocessing routine. A procedure is outlined which, given two or more such line structures obtained from different vantage points, will yield a description of the three-dimensional scene, in spite of limited number of imperfections in the line structure data (e.g., missing, extraneous, or improperly joined line segments). GRA

N76-29974# Arizona Univ., Tucson. Dept. of Mathematics.
SINGULAR PERTURBATIONS AND SINGULAR ARCS, PART 2
Robert E. OMalley, Jr. and Antony Jameson (New York Univ.) Jan. 1976 33 p refs
(Contract N00014-76-C-0326; AT(11-1)-3077; NR Proj. 041-466)
(AD-A020379; TR-12-Pt-2) Avail: NTIS CSCL 12/1

This sequel to the author's previous paper studies a nearly singular time-varying linear regulator problem. The asymptotic solution is completely developed in one typical case and its generalization is outlined. The problem is relevant to several important applications and illustrates the impulsive endpoint behavior necessary for singular arc solutions to singular control problems. GRA

N76-29975# General Electric Co., Syracuse, N.Y. Heavy Military Equipment Dept.
MINIMUM MEAN-SQUARED-ERROR ESTIMATION IN NONLINEAR PROBLEMS WITH GAUSSIAN INPUTS Ph.D. Thesis
K. A. Olsen Jan. 1976 391 p refs
(AD-A021731; R76EMH3) Avail: NTIS CSCL 12/1

In this report, general theorems for estimation of nonlinear functions of Gaussian random processes are developed. Based on these general theorems, minimum mean-squared-error nonlinear estimators for the time average autocorrelation function and the time average power spectral density function of a sample function of a random process are formulated. Examples and performance curves are given for both stationary and nonstationary processes. Additional nonlinear estimators are analyzed, with emphasis on nonergodic situations such as those that occur when an observation interval is finite, and these estimators are shown to be capable of outperforming the minimum mean-squared-error estimator on a single trial basis. GRA

N76-29976# Wisconsin Univ., Madison. Mathematics Research Center.
THE STRUCTURE OF STABILITY MATRICES AND RELATED TOPICS IN DIFFERENTIAL MATRIX THEORY Technical Summary Report
D. L. Lukes Oct. 1975 53 p refs
(Contract DAAG29-75-C-0024)
(AD-A020196; MRC-TSR-1001) Avail: NTIS CSCL 12/1

This paper studies the invariance of zero sets of functions relative to vector and matrix differential equations. It also develops the structure theory of stability matrices and applies the results to stability problems from control theory. GRA

N76-29977# Linkabit Corp., San Diego, Calif.
THEORETICAL STUDIES IN THE APPLICATIONS OF THE VITERBI ESTIMATION AND THEORETICAL NETWORKS Final Report
1 Nov. 1975 100 p refs
(Contract N00123-75-C-0557)
(AD-A022277) Avail: NTIS CSCL 09/4

This paper extends and generalizes some earlier results on syndrome decoding of rate-1/2 convolutional codes. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-29978 Texas Univ., Austin.
SERIES SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS. A STUDY OF THE SINGULARITIES, EXPANSIONS AND SOLUTIONS OF SCHROEDINGER'S EQUATION FOR THE HELIUM ATOM Ph.D. Thesis
Morris Sasson Mahlab 1975 158 p
Avail: Univ. Microfilms Order No. 76-14490

A technique for solving Schroedinger's differential equation for helium-like atoms is presented. Different expansions are picked such that they converge rapidly in each of the different subdivisions. These expansions may be constructed in such a way that they obey the boundary conditions in their respective subdivision. Most importantly, all the information available from the recursion relations associated with the differential equation may be incorporated into these expansions. A systematic procedure is presented such that these expansions may be brought together to form a wave function that satisfies all the continuity requirements. An S-state helium wave function was constructed to demonstrate that this method of treatment is feasible, and capable of indefinite systematic improvement. Asymptotic expansions that were constructed for the helium wave function, as well as an improved functional form for the small electron-nucleus wave function are also discussed. Dissert. Abstr.

N76-29979 California Univ., Berkeley.
ELEMENTARY-RECURSIVE DECISION PROCEDURES Ph.D. Thesis
Leonard Gaines Monk 1975 89 p
Avail: Univ. Microfilms Order No. 76-15318

A subclass of the primitive recursive functions called the elementary-recursive functions is considered. A form of the decision procedure for the theory of real closed fields was used to show that the characteristic function of this theory can be computed by a Turing machine. Also investigated are polynomial log space, and a much smaller class of functions, each of which can be computed by a Turing machine. Various functions are shown to be in polynomial log space. An elimination of quantifiers (in an expanded language) for the theory of Abelian groups was used to show that this theory is elementary-recursive, and that decidability is retained when a new unary predicate defining a group's torsion subgroup is added to the language.
Dissert. Abstr.

N76-29980*# Santa Clara Univ., Calif. School of Engineering.
THE RELATION OF FINITE ELEMENT AND FINITE DIFFERENCE METHODS Final Technical Report, 1 Aug. 1975 - 31 Jul. 1976
Marcel Vinokur 31 Jul. 1976 55 p refs
(Grant NSG-2086)
(NASA-CR-148566; ME-76-3) Avail: NTIS HC $4.50 CSCL 12A

Finite element and finite difference methods are examined in order to bring out their relationship. It is shown that both methods use two types of discrete representations of continuous functions. They differ in that finite difference methods emphasize the discretization of independent variables, while finite element methods emphasize the discretization of dependent variables (referred to as functional approximations). An important point is that finite element methods use global piecewise functional approximations, while finite difference methods normally use local

functional approximations. A general conclusion is that finite element methods are best designed to handle complex boundaries, while finite difference methods are superior for complex equations. It is also shown that finite volume difference methods possess many of the advantages attributed to finite element methods. Author

N76-29981# Polish Academy of Sciences, Warsaw.
THE SECOND BOUNDARY PROBLEM FOR A MULTIPHASE ELASTIC HALF-SPACE [DRUGIE ZAGADNIENIE BRZEGOWE DLA WIELOFAZOWEJ POLPRZESTRZENI SPREZYSTEJ]
Elzbieta Kamienobrodzka 13 Nov. 1975 10 p refs In POLISH
Avail: NTIS HC $3.50

A multiphase medium, i.e., a medium with stochastically heterogeneous structure and granular composition, is examined. A grain is considered to be a compact zone filled with an elastically homogeneous material. A collection of grains differing at most in orientation is called a phase. The tensor of elasticity for a given phase is constant with an accuracy up to a complete orthogonal group. It is established that the geometry of the analyzed medium has a stochastic character and is invariable in the course of the process under study. It is postulated that the obtained formulas for average magnitudes hold not only for an even distribution of heterogeneity, but also in the case of uneven heterogeneity. A solution is sought to the second boundary problem for a multiphase elastic half space. Author

N76-29982# Joint Inst. for Nuclear Research, Dubna (USSR).
NEAR TO MINIMAL CANONICAL REALIZATIONS OF THE LIE ALGEBRA Cn
M. Havlicek and W. Lassner 1975 17 p refs Submitted for publication
(JINR-E2-9161) Avail: ERDA Depository Libraries HC $4.50

It is proved that canonical realizations of the Lie algebra C sub N in the quotient division ring D sub 2(2n-2) of the Weyl algebra W sub 2(2n-2) in 2n-2 quantum canonical pairs are, in a definite sense, related to the standard minimal one. Further, in any realization of C sub n in W sub 2(2n-1) all Casimir operators are realized by multiples of the identity element. Author (NSA)

N76-29983# Democritus Nuclear Research Center, Athens (Greece).
PARAMETRIC IDENTIFICATION USING DISCRETE LAGUERRE POLYNOMIALS
P. N. Paraskevopoulos and R. E. King Jan. 1976 19 p refs
(DEMP-76/1) Avail: ERDA Depository Libraries HC $3.50

A fast numerical technique for parameter identification of linear time-invariant discrete systems is presented. The technique is based on a representation of input and output sequences by means of truncated discrete Laguerre series. Author (ERA)

N76-29984# Wisconsin Univ., Madison. Mathematics Research Center.
ON A VOLTERRA INTEGRODIFFERENTIAL EQUATION IN A BANACH SPACE
S. O. Londen Oct. 1975 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A017999/4; MRC-TSR-1558) Avail: NTIS HC $4.00 CSCL 12/1

Conditions are given for the local existence of solutions of a nonlinear integral equation in a Banach space, where A is a monotone mapping from the space into its dual. Applications are given. Author

N76-29985# Washington Univ., Seattle. Dept. of Mathematics.
WHEN IS A MATRIX SIGN STABLE
Clark Jeffries, Victor Klee, and Pauline VanDenDriessche Feb. 1976 25 p refs Supported in part by Office of Naval Research
(Contracts N00014-67-A-0103-0003; N00014-76-C-0423; NR Proj. 044-353)
(AD-A022329; TR-58) Avail: NTIS CSCL 12/1

A square real matrix A is called sign stable or qualitatively stable if stability is a property of every matrix having the same sign-pattern (negative, zero, positive) as A. A combinatorial characterization of this notion in an efficient algorithm for testing sign stability is established. Author (GRA)

N76-29986# Carnegie-Mellon Univ., Pittsburgh, Pa.
THE COMPLEXITY OF OBTAINING STARTING POINTS FOR SOLVING OPERATOR EQUATIONS BY NEWTON'S METHOD
H. T. Kung Oct. 1975 28 p refs
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111)
(AD-A020208) Avail: NTIS CSCL 12/1

The complexity of searching for good starting points for iterations is studied. Global and non-asymptotic results are obtained: A useful lemma for proving lower bounds is identified, several optimal results are given for scalar equations, and upper bounds for operator equations are established by a new procedure for obtaining starting points for Newton's method. GRA

N76-29987# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
STRICT LOWER AND UPPER BOUNDS ON ITERATIVE COMPUTATIONAL COMPLEXITY
J. F. Traub and H. Wozniakowski Aug. 1975 24 p refs Submitted for publication
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A020207) Avail: NTIS CSCL 12/1

A non-asymptotic theory of iterative computational complexity was constructed with strict lower and upper bounds. In order to make the complexity ideas as accessible as possible the authors have limited themselves to scalar non-linear problems. GRA

N76-29988# Union Coll., Schenectady, N.Y. Institute of Administration and Management.
POINT ESTIMATION AND CONFIDENCE INTERVAL ESTIMATION FOR BINOMIAL AND MULTINOMIAL PARAMETERS Final Report, 1 Jan. - 31 Dec. 1975 Ph.D. Thesis
Ramesh Chandra 31 Dec. 1975 25 p refs
(Contract N00014-75-C-0583; NR Proj. 042-302)
(AD-A021208; AES-7514) Avail: NTIS CSCL 12/1

This study deals with the estimation of parameter(s) of binomial or multinomial distribution using the data available at the termination of a sequential experiment. GRA

N76-29989# Watervliet Arsenal, N.Y.
ON A NEW ADJOINT OPERATOR AND APPLICATIONS
Julian J. Wu Dec. 1975 25 p
(AD-A020425; WVT-TR-75068) Avail: NTIS CSCL 12/1

For a given linear differential operator, a bilinear identity is established between two arbitrary functions. Using this identity, two boundary value problems, each is said to be the adjoint of the other, can be uniquely defined. An unconstrained variational principle follows immediately. The complete system is said to be intrinsic to the given differential operator. The intrinsic identity can be modified by including additional boundary terms of a specific form. Thus, more general boundary value problems and their unique adjoints can be included. The associated variational principles also follow easily. These formulations are concisely summarized by introducing a new adjoint operator. Several physical examples are given that lead to correct adjoint problems and associated variational principles. GRA

N76-29990# Wisconsin Univ., Madison. Mathematics Research Center.
ASYMPTOTIC STABILITY AND ENERGY DECAY RATES FOR SOLUTIONS OF HYPERBOLIC EQUATIONS WITH BOUNDARY DAMPING Technical Summary Report
John P. Quinn and David L. Russell Nov. 1975 70 p refs
(Contract DAAG29-75-C-0024; NR Proj. 041-404)
(AD-A020205; MRC-TSR-1575) Avail: NTIS CSCL 12/1

This report deals with the asymptotic behavior of solutions of the wave equation in a domain omega a subset or equal to (R sup n). The boundary Gamma, of omega consists of two parts. One part reflects all energy while the other part absorbs energy to a degree. If the energy absorbing part is non-empty the authors show that the energy tends to zero as t nears

infinity. With stronger assumptions one is able to obtain decay rates for the energy. Certain relationships with controllability are discussed and used to advantage. GRA

N76-29991# Wisconsin Univ., Madison. Mathematics Research Center.
FACTORIAL EXPANSIONS FOR CERTAIN BESSEL FUNCTIONS Technical Summary Report
J. Barkley Rosser Nov. 1975 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A020204; MRC-TSR-1572) Avail: NTIS CSCL 12/1

For certain of the Bessel functions which get small for large real values of the argument, it is difficult to calculate accurate values when the argument is large. For some of these, one can write expansions in terms of factorial series, which take care of the matter quite well. In these expansions, one can use complex values of the argument as well as real, for suitable ranges. GRA

N76-29992# Wisconsin Univ., Madison. Mathematics Research Center.
EFFECT OF CORRELATION ON THE ESTIMATION OF A MEAN IN THE PRESENCE OF SPURIOUS OBSERVATIONS Technical Summary Report
Irwin Guttman and G. C. Tiao Nov. 1975 37 p refs
(Contract DAAG29-75-C-0024; Grant
DA-ARO(D)-31-124-72-G162)
(AD-A020212; MRC-TSR-1585) Avail: NTIS CSCL 12/1

This paper examines the effect of various correlation structures of observations on rules for estimating a mean which are designed to guard against the possibility of spurious observations (that is, observations generated in a manner not intended). The premium and protection of these rules are evaluated and discussed for the equi-correlation case and for the case of an autoregressive process of first order. It is shown that the premium and protection of a given rule which is designed for the estimator of a general mean mu when spuriosity may exist and when the observations are independent, lacks robustness to departures from independence. It is also shown that in moderate sized samples a spurious observation could seriously bias the usual estimator of the autoregressive coefficient alpha. One application of these results is in the case of a first order autoregressive model which can be used to represent many time series data encountered in business and economics. GRA

N76-29993# Wisconsin Univ., Madison. Mathematics Research Center.
THE CONCEPT OF A BEST APPROXIMATION AS AN OPTIMALITY CRITERION IN STATISTICAL DECISION THEORY
Bernard Harris and Gerhard Heindl Dec. 1975 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A020213; MRC-TSR-1586) Avail: NTIS CSCL 12/1

The concept of a best approximation from a convex set in a normed linear space is interpreted as a natural choice for a concept of optimality in statistical decision. The fundamental distinction for statistics is that there is a specific orientation to the approximation induced by the notion of admissibility in statistical decision theory. GRA

N76-29994# Wisconsin Univ., Madison. Mathematics Research Center.
THE OVERESTIMATION OF THE RANGE OF A FUNCTION IN INTERVAL MATHEMATICS WITH APPLICATION TO THE SOLUTION OF LINEAR SYSTEMS OF EQUATIONS
Karl Nickel Dec. 1975 42 p refs
(Contract DAAG29-75-C-0024)
(AD-A020214; MRC-TSR-1593) Avail: NTIS CSCL 12/1

Interval arithmetic was introduced by R. E. Moore in 1966. It helps to get bounds for the range of a function. Sometimes - but not always - these bounds overestimate the range, sometimes they are even extremely pessimistic. In what follows the reasons for this behaviour will be shown. Furthermore criteria are developed which show if a function is 'optimal';, i.e. not overestimating the range. An application of this theory to linear systems of equations is given. It produces classes of matrices and of right hand sides for which the Gauss elimination method has this optimality. GRA

N76-29995# Wisconsin Univ., Madison. Mathematics Research Center.
PLANE PARTITIONS (1): THE MAC MAHON CONJECTURE Technical Summary Report
George E. Andrews Nov. 1975 38 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-74-07282)
(AD-A020218; MRC-TSR-1606) Avail: NTIS CSCL 12/1

The object of this paper is to prove Mac Mahon's conjecture. The proof is primarily concerned with the evaluation of certain n x n determinants, and the methods developed should be applicable to related problems. GRA

N76-29996# Wisconsin Univ., Madison. Mathematics Research Center.
SOME LOCAL EXISTENCE RESULTS OF AN INTEGRAL EQUATION IN A BANACH SPACE Technical Summary Report
S. O. Londen Oct. 1975 32 p refs
(AD-A020201; NRC-TSR-1556) Avail: NTIS CSCL 12/1

A local existence result is proved for the nonlinear integral equation u'(t) + the integral from 0 to t of a(t-tau)Au(tau)d tau =f(t), t > or = 0, where the kernel a of the equation is a real-valued function, A is a nonlinear monotone mapping and u takes values in a Banach space. The author's aim is to obtain results on 'bad' nonlinearities and to obtain these he finds it necessary to make rather strong assumptions on the kernel. The results are used to obtain 'approximating' solutions to the related nonlinear hyperbolic differential equation (u double prime)(t) + Au(t) = f(t), t > or = 0. GRA

N76-29997# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
ITERATIVE SOLUTIONS OF INVERSE EIGENVALUE PROBLEMS FOR JACOBI MATRICES
Victor Barcilon Jan. 1976 20 p refs
(Contract N00014-76-C-0034; NR Proj. 041-476)
(AD-A021438) Avail: NTIS CSCL 12/1

An iterative method is given for reconstructing a Jacobi matrix from spectral data. GRA

N76-29998# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A MODEL-DRIVEN GEOMETRY THEOREM PROVER
Shimon Ullman May 1975 58 p refs
(Contract N00014-75-C-0643)
(AD-A021446; AI-M-321) Avail: NTIS CSCL 12/1

This paper describes a new Geometry Theorem Prover, which was implemented to illuminate some issues related to the use of models in theorem proving. The paper is divided into three parts: Part 1 describes the G.T.P. and presents the ideas embedded in it. Part 2 describes the backward search mechanism. Part 3 addresses the notion of similarity in a problem, defines a notion of semantic symmetry, and compares it to Gelernter's concept of syntactic symmetry. GRA

N76-29999# Army Electronics Command, Fort Monmouth, N.J.
SOME EFFECTS OF AUTOCORRELATED AND CROSS-CORRELATED NOISE ON THE ANALYSIS OF VARIANCE
Elton P. Avara Dec. 1975 43 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A022045; ECOM-5582) Avail: NTIS CSCL 12/1

The standard estimators of the various means and variances used in the analysis of variance (ANOVA) hypothesis testing are not suitable if the noise is autocorrelated. For colored noise, the estimates obtained from these standard estimators are biased and their distributions are not the same as the distributions of their white noise counterparts. As a result, hypothesis testing using these estimates is unreliable and misleading. The method of maximum likelihood is used to obtain new estimators of the means and variances required in ANOVA which account for the nonwhite noise effects. These estimators are linear and quadratic forms whose coefficients are derived from the correlation matrix of the noise. Estimates obtained from these new estimators are suitable for use in standard ANOVA hypothesis testing. Some effects of using the wrong estimators in the presence of autocorrelated and cross-correlated noise are investigated, assuming a linear, first-order Markov model for the noise. White noise is a special case of this more general model. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-30000 Georgia Inst. of Tech., Atlanta.
ON MONTE CARLO DISTRIBUTION SAMPLING, WITH APPLICATION TO THE COMPONENT RANDOMIZATION TEST Ph.D. Thesis
Bruce Wayne Schmeiser 1975 199 p
Avail: Univ. Microfilms Order No. 76-15597

Component randomization tests of statistical hypotheses have good mathematical properties and are distribution-free. While the power of these tests is well known for asymptotically large samples, little is known for finite sample sizes. The power of the component randomization test of location in a paired sample design for finite sample sizes was studied. The component randomization test is computationally difficult, requiring approximately the effort of 2h Student t tests, where n is sample size. Previously, Monte Carlo-studies were not applied directly since the thousands of samples necessary for adequate results would require an unreasonable amount of computer effort. Methods of Monte Carlo distribution sampling were developed to allow the Monte Carlo approach to be used, and are described. Areas of interest included quantile estimation, process generation, methods of performing the component randomization test efficiently, and variance reduction. Dissert. Abstr.

N76-30001# Wisconsin Univ., Madison. Mathematics Research Center.
THE STATISTICAL ESTIMATION OF ENTROPY IN THE NON-PARAMETRIC CASE
Bernard Harris Dec. 1975 47 p refs
(Contract DAAG29-75-C-0024)
(AD-A020217; MRC-TSR-1605) Avail: NTIS CSCL 12/1

Assume that N mutually independent observations have been taken from a population. The classes are not assumed to have a natural ordering. The natural estimator is shown to have certain deficiencies when the number of classes is large relative to the sample size or is infinite. A procedure based on quadrature methods is proposed as a means of circumventing these deficiencies. Author

N76-30002# Control Analysis Corp., Palo Alto, Calif.
DETERMINATION OF RUN LENGTH IN SIMULATIONS OF STABLE STOCHASTIC SYSTEMS
David W. Robinson Feb. 1976 47 p refs
(Contract N00014-72-C-0086; NR Proj. 047-106)
(AD-A021447; TR-86-20) Avail: NTIS CSCL 12/1

Existing results in the theory of sequential estimation are not broad enough to provide the simulation practitioner with adequate guidance as to when to terminate a simulation run. This report extends the theory to include estimates which arise in simulations and then describes a series of experiments undertaken to investigate the effect of random stopping rules in regenerative simulations. It is found that extreme care must be exercised in interpreting the results of such simulations because the probability coverage of the final confidence interval is often much lower than the a priori specified value. GRA

N76-30003# Control Analysis Corp., Palo Alto, Calif.
THE REGENERATIVE METHOD FOR SIMULATION ANALYSIS
Donald L. Inglehart Oct. 1975 46 p refs
(Contract N00014-72-C-0086; NR Proj. 047-106)
(AD-A021448; TR-86-20) Avail: NTIS CSCL 12/1

This paper contains an expository account of the regenerative method for simulating stable stochastic systems. GRA

N76-30004# Texas Univ., Austin. Center for Research in Water Resources.
STOCHASTIC PROJECTIONS FOR WATER RESOURCES PLANNING Final Report
Leo R. Beard and Shin Chang 30 Dec. 1975 157 p refs
(Contract DI-14-31-0001-9088)
(PB-250150/0; W76-05012; CRWR-131;
OWRT-C-5340-X(9088)(2)) Avail: NTIS HC $6.75 CSCL 13B

Computerized algorithms were developed for finding the best stochastic projection models for single variable projections and for simultaneous multivariate projections. For single variable projection, the best model was selected by the algorithm from the autoregressive integrated moving average family of models on the basis of goodness to fit with observed data and reasonableness of projections. For multivariate projections, principal component analysis was allied with the single variable projection technique to produce simultaneous projections of all variables. Projections of thirty one sample series were presented. Two FORTRAN computer programs used in the sample series projections were listed. Author (GRA)

N76-30005# Cambridge Systematics, Inc., Mass.
NON-RANDOM SAMPLING IN THE CALIBRATION OF DISAGGREGATE CHOICE MODELS Final Report
Steven R. Lerman, Charles F. Manski, and Terry J. Atherton Feb. 1976 56 p refs Sponsored by DOT
(PB-250640/0; FHWA/PO-6-3-0021) Avail: NTIS HC $4.50 CSCL 13B

Several basic conclusions are reached regarding alternative sampling procedures and the development of disaggregate choice models. (1) Disaggregate choice travel demand models calibrated on stratified samples require no special adjusting or weighting. (2) Disaggregate choice travel demand models calibrated on choice based samples do require adjusting or weighting. (3) The appropriate weight for modifying each choice based sample observation is simply: Probability of a randomly drawn sample making that choice; probability of a choice based sample making that choice. Author (GRA)

N76-30006# United Technologies Research Center, East Hartford, Conn.
STOCHASTIC REGULATION OF NONLINEAR MULTIVARIABLE DYNAMIC SYSTEMS Final Technical Report, 1 Feb. 1973 - 31 Jan. 1976
Gerald J. Michael and Florence A. Farrar Mar. 1976 57 p refs
(Contract N00014-73-C-0281; NR Proj. 215-219)
(AD-A021451; R76-941620-4) Avail: NTIS CSCL 12/1

Estimation and control algorithms were developed and evaluated for closed-loop regulation of noise-corrupted nonlinear multivariable dynamic systems. The stochastic regulation design procedures involve (1) deterministic multivariable feedback control design at a steady-state operating condition using linear quadratic regulator theory, (2) stochastic estimator design as defined in this study, and (3) closed-loop regulation based on feedback of estimated system state and selected output variables through the deterministic control logic. Four state estimation algorithms were defined: (1) digital smoothing of noisy measurements, (2) digital smoothing plus sensor compensation, (3) Kalman estimation logic using assumed linear plant and sensor dynamics, and (4) Kalman estimation with model-mismatch compensation logic which accommodates uncertainties associated with characterization of nonlinear plant dynamics by an assumed linear model. The developed methodology was evaluated by application to a nonlinear dynamic simulation of the F100/F401 turbofan engine at the military power operating condition. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-30007# Polish Academy of Sciences, Warsaw.
PROBLEMS OF IDENTIFICATION OF TECHNICAL SYSTEMS WITH SPECIAL CONSIDERATION OF MECHANICAL CONFIGURATIONS [PROBLEMY IDENTYFIKACJI SYSTEMOW TECHNICZNYCH ZE SZCZEGOLNYM UWZGLEDNIENIEM]
Jerzy Wicher 13 Nov. 1975 197 p refs In POLISH
Avail: NTIS HC $7.50

The body of problems connected with identification are reviewed and the specifics of mechanical configurations are considered for a class of technical systems. Problems such as the role of the investigator, the experimental problem, considera-

tion of certain characteristics of mathematical models are discussed. Current trends in the development of the theory of identification are indicated. An attempt at modification of the statistical linearization method for identification of a nonlinear mechanical configuration is offered. Problems concerning the use of a method of regressive analysis for identification of mechanical configurations are also considered. The goal was to determine the correct analytical dependencies and to develop a methodology for identification of the parameters of mechanical configurations with the use of electronic computer technology. Results in identification of mathematical models of machine tool assemblies are presented. Author

N76-30008# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
EQUILIBRIUM PROPERTIES OF ARBITRARILY INTERCONNECTED QUEUEING NETWORKS
Frederick J. Beutler, Benjamin Melamed, and Bernard P. Zeigler Jul. 1975 32 p refs
(Contracts N00014-67-A-0181-0047; N00014-75-C-0492; Grant AF-AFOSR-2903-76; NR Proj. 042-296)
(AD-A021332; TR-75-4) Avail: NTIS CSCL 12/2

Considered are properties of arbitrarily interconnected queueing networks of single server nodes with exponential service and Poisson exogenous inputs. Customers departing node i are instantaneously routed to node j with probability (p sub ij), or depart the system with probability (q sub i). GRA

N76-30009# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
TWO FINITE QUEUES IN TANDEM WITH PURE DELAY AND OVERFLOW
Benedict Chung Wong Jul. 1975 91 p refs
(Contract N00014-75-C-0492; NR Proj. 042-296)
(AD-A021288; TR-75-7) Avail: NTIS CSCL 12/2

Two single server queues with finite capacities are arranged in tandem. The arrival process to the first server is a Poisson stream with rate lambda. The respective service times in the two servers are mutually independent, negative exponential distributed random variables, independent of the arrival process, with rates (Mu sub 1) and (Mu sub 2) respectively. The queue is assumed to be of first-come, first-served discipline. Both the pure delay (BCD) and the overflow (BCO) models are considered. The steady state solution is given. GRA

N76-30010# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
SIMPLIFICATIONS OF JACKSON QUEUEING NETWORKS
Frederick J. Beutler, Benjamin Melamed, and Bernard P. Zeigler Aug. 1975 77 p refs
(Contract N00014-75-C-0492; Grant NSF DCR-71-01997; NR Proj. 042-296)
(AD-A021289; TR-163) Avail: NTIS CSCL 12/2

This paper deals with valid simplifications of a class of queueing networks. A valid simplification is a complexity reducing map from queuing networks into queuing networks that preserves or reasonably approximates the stochastic properties of interest. The paper exemplifies such maps for the class of Jackson queuing networks (independent Poisson inputs, independent Exponential servers, FIFO queue disciplines and memoryless decomposition switches). To ensure true complexity reduction the authors insist that the lumped network (i.e. the result of an attempted simplification) also be a Jackson network. It is shown that this is not possible for arbitrary networks. Reasonable conditions under which such simplifications are possible are provided. In the process, the authors expose a number of gaps in the theory of Jackson networks as it now stands and settle one of the, the question of existence and uniqueness of a solution to the so called 'traffic equilibrium equation'. GRA

N76-30011# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
THE QUEUE LENGTH PROCESS OF THE M2/G2/1 QUEUE WITH BERNOULLI FEEDBACK
Ralph L. Disney and Gilles R. DAvignon May 1975 34 p refs Presented at ORSA/TIMS Natl. Meeting, Chicago, 30 Apr. - 2 May 1975
(Contract N00014-75-C-0492; NR Proj. 042-296)
(AD-A021291; TR-75-6; TR-75-10) Avail: NTIS CSCL 12/2

Conditions under which single server queues with feedback are equivalent to single server queues without feedback for the queue length, busy period and departure process are known. This paper presents some properties of those queues for which these conditions are not met. Foreground-background computer models are in this class and those with Poisson arrival processes serve as illustrations of the general results. GRA

N76-30012# California Univ., Los Angeles. School of Engineering and Applied Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 1 Jan. - 30 Jun. 1975
Leonard Kleinrock 30 Jun. 1975 55 p refs
(Contract DAHC15-73-C-0368)
(AD-A020671) Avail: NTIS CSCL 09/2

This semiannual Technical Report covers three important research fields. The first research area is the study of computer communications. The second area of research is that of security and protection in computer systems. Our third area of research involves the use of algorithmic methods in combinatorially complex problems which are of use in computer systems. GRA

N76-30013# Naval Ship Research and Development Center, Bethesda, Md.
NAVLIS PILOT NETWORK EXECUTIVE CONTROL SUBSYSTEM SPECIFICATION Interim Report
B. A. Wallis and H. L. Magnan Jun. 1975 101 p refs
(AD-A022335; DTNSRDC-4735) Avail: NTIS CSCL 09/2

The Navy is engaged in the development of a Navy Logistics Information Sharing (NAVLIS) capability. This report contains the detail design specifications for the Executive Control Subsystem of the NAVLIS Pilot Network being developed to test and evaluate the NAVLIS baseline concept. These specifications will serve as a basis for the development of specifications for lower-level software and will be of interest to those persons interested in the architecture of the NAVLIS Executive Subsystem software. GRA

N76-30014# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
FEEDBACK QUEUES IN THE MODELLING OF COMPUTER SYSTEMS: A SURVEY
Roberta Jean Wyszewianski and Ralph L. Disney Dec. 1975 95 p refs Revised
(Contracts N00014-75-C-0492; N00014-67-A-0181-0046; N00014-67-A-0181-0047; NR Proj. 042-296)
(AD-A021528; TR-74-1-Rev) Avail: NTIS CSCL 09/2

This paper is a survey of feedback queueing models developed for modelling computer systems. In particular, round-robin and foreground-background time-sharing models, as well as some related feedback models, are presented with the main assumptions of these models and main results summarized in tables. The derivations and the mathematical expression of the results can be found in the cited references. The recent, related work in computer modelling using queueing networks and diffusion approximation and other approximate methods is also surveyed. GRA

N76-30015# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
DECOMPOSITION AND CUSTOMER STREAMS OF FEEDBACK QUEUEING NETWORKS IN EQUILIBRIUM
Frederick J. Beutler and Benjamin Melamed Sep. 1975 29 p refs
(Contract N00014-75-C-0492; Grant AF-AFOSR-2903-76; NR Proj. 042-296)
(AD-A021238; TR-75-5) Avail: NTIS CSCL 12/2

P. J. Burke and E. Reich independently showed the output of a M/M/1 queue in equilibrium to be a Poisson process. Consequently, analysis of tandem exponential servers with a Poisson input stream can be reduced to consideration of a series of M/M/1 queues. This work generalizes the above results to so-called Jackson networks, which consists of exponential servers with mutually independent Poisson exogenous inputs and random customer routings permitting customer feedback. The authors prove that traffic on all exit arcs is Poisson; moreover, the customer streams leaving any exit set are mutually independent. GRA

N76-30016# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
COVARIANCE PROPERTIES FOR THE DEPARTURE PROCESS OF M/E SUB K/1/N QUEUES
Ralph L. Disney and Paulo R. DeMorais (Northwestern Univ.) Sep. 1975 27 p refs
(Contract N00014-75-C-0492; NR Proj. 042-296)
(AD-A021237; TR-75-8) Avail: NTIS CSCL 12/2

General formulas for the variance and covariance, 1ag 1, terms are given for the departure processes of M/G/1/N queues. A general formula for M/(E sub k)/1/N queues, for the covariance, 1ag 1, is given. Detailed analysis is given for M/M/1/N and M/(E sub k)/1/1 queues. Some numerical results for M/(E sub k)/1/N queues are given in graphical form. GRA

N76-30017# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
NETWORKS OF QUEUES WITH DELAYED FEEDBACK
Ingjaldur Hannibalson Jun. 1975 112 p refs
(Contract N00014-75-C-0492; NR Proj. 042-296)
(AD-A021236; TR-75-10) Avail: NTIS CSCL 12/2

The problem of queueing systems with feedback has received little attention in the queueing literature. The queue with instantaneous feedback has been more studied, recently, than the queue with randomly delayed feedback. In this paper the author presents some results for M/M/1 queues with finite capacities with delayed feedback. The delay in the feedback to an M/M/1 queue is modelled as another M-server queue with a finite capacity. Then the output from server 1 progresses to server 2 with probability p and leaves the system with probability q. Arrivals at server 2 join a waiting line, if necessary, are served and return to server 1 with probability 1. In this way server 2 acts as a delay mechanism in the feedback stream. All new arrivals are to server 1. The steady state probabilities for the two dimensional Markov process (N(t), M(t)) are solved when N(t) = queue length at server 1 at t and M(t) = queue length at server 2 at t. A sample problem is run to show that the solution methods can be programmed and meaningful results obtained numerically. GRA

N76-30018# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
THE NETWORK MEASUREMENT MACHINE: A DATA COLLECTION DEVICE FOR MEASURING THE PERFORMANCE AND UTILIZATION OF COMPUTER NETWORKS
Robert Rosenthal, Don E. Rippy, and Helen M. Wood Apr. 1976 94 p refs
(PB-252187/0; NBS-TN-912) Avail: NTIS HC $5.00 CSCL 09B

The Network Measurement Machine (NMM) is a device used to acquire data for the performance measurement of computer network systems and services. By focusing on the service delivered to network customers at their terminals, measurements can be made that are directly relevant to user needs and to management concerns. The details of a data acquisition device are presented. The device is a minicomputer-based system that employs regular (off-the-shelf) and special purpose hardware under the control of a specially written software acquisition system. The technical aspects of inserting the NMM into the data communications portion of a computer network are discussed. GRA

N76-30019# National Science Foundation, Washington, D.C. Div. of Computer Research.
COMPUTER SYSTEMS. VOLUME 42, 1970: COLLECTION OF ARTICLES
E. V. Evreinov and Yu. G. Kosarev Jan. 1975 153 p refs Transl. into ENGLISH of Vychislitelnye Sistemy (USSR), vol. 42, 1970
(TT-72-52018) Avail: NTIS HC $6.75 CSCL 09B

Contents: A parallel algorithm for solving taxonomy problems; Systems approach in designing compilers for computer systems; Metalanguage for syntax controlled compilers; Algorithms for planning the working of a dispatcher in a uniform computer system; Functioning of a unified computer system in the presence of a priority stream of large problems; Configurations of computer systems which are stable toward the change in the number of machines; Improvement in the command system of the computer 'Minsk-222'; Evaluation of pseudo-random number generator; Extremal property of cubic splines and the smoothing problem; Extremal property of bicubic splines and the smoothing problem; Appendix-command system for 'Minsk-222'. GRA

N76-30020# Maryland Univ., College Park. Dept. of Computer Science.
TRANSIENT FAULT RECOVERY IN THE DISTRIBUTED COMPUTER NETWORK Interim Report
David L. Mills Feb. 1976 26 p refs
(Contract N00014-67-A-0239-0032; Grant NSF GK-41602)
(AD-A022018; TR-414) Avail: NTIS CSCL 09/2

This paper describes a set of algorithms proposed for recovery from hardware and software failure in a distributed computer network. These algorithms are designed so that, in most cases of temporary failure in a processor, storage medium or input/output device, the remaining components elsewhere in the network continue to function. When the failure is repaired the system automatically reconfigures itself to include the failed component. Author (GRA)

N76-30021# Maryland Univ., College Park. Dept. of Computer Science.
DYNAMIC FILE ACCESS IN A DISTRIBUTED COMPUTER NETWORK
David L. Mills Feb. 1976 32 p refs
(Contract N00014-67-A-0239-0032; Grant NSF GK-41602)
(AD-A022088; TR-415) Avail: NTIS CSCL 09/2

This paper describes the design of a system for accessing files and other named objects in a distributed computer network. The system includes a set of mutually cooperating portable processes which, together with other processes which support user programs, can migrate dynamically between the computers of the network. Important features in the design include an efficient access method which minimizes dictionary searches to find a file when its location is unknown in advance and a robust recovery procedure that insures the integrity of the system should one or more of the processes or computers fail. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-30022 Princeton Univ., N.J.
A THEORY OF ENTROPY IN FOURIER ANALYSIS Ph.D. Thesis
Robert Allen Fefferman 1975 52 p
Avail: Univ. Microfilms Order No. 76-16560

A certain set function called entropy and its applications to some problems in classical Fourier analysis was studied. Notions related to entropy were used in order to investigate the maximal operator M Omega, where Omega is a positive function, homogeneous of degree 0, and satisfying a certain weak smoothness condition. Then the set function entropy was investigated, and certain of its properties derived. These were then used to solve various problems in differentiation theory and the theory of singular integrals, derving in the process, entropic versions of the theorems of Hardy-Littlewood and Calderon-Zygmund. Dissert. Abstr.

N76-30023# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CONVERGENCE OF THE GENERALIZED NEWTON METHOD
S. R. Avramov 1975 16 p refs In RUSSIAN
(JINR-P11-9222) Avail: NTIS HC $3.50

The problems of nonlocal convergence of the generalized Newton method for the case of the Banach spaces are investigated. A theorem on total convergence of the generalized Newton method is obtained. Author (ERA)

N76-30024# Naval Postgraduate School, Monterey, Calif.
A MIXED AUTOREGRESSIVE-MOVING AVERAGE EXPONENTIAL SEQUENCE AND POINT PROCESS (EARMA 1,1)
P. A. Jacobs and P. A. W. Lewis Oct. 1975 37 p refs
(NR Proj. 042-284; RR0140501)
(AD-A021824; NPS-55Lw75101) Avail: NTIS CSCL 12/1

A stationary sequence of random variables with exponential marginal distributions and the correlation structure of an EARMA (1,1) process is defined. The process is formed as a random linear combination of i.i.d. exponential random variables and is very simple to generate on a computer. Moments and joint distributions for the sequence are obtained, as well as limiting properties of sums of the random variables and of the point process whose intervals have the EARMA (1,1) structure. GRA

N76-30025# Wisconsin Univ., Madison. Mathematics Research Center.
LADDER SETS AND REGENERATIVE PHENOMENA: FURTHER REMARKS AND SOME APPLICATIONS Technical Summary Report
N. U. Yrabhu Dec. 1975 19 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-73-04437)
(AD-A020206; MRC-TSR-1577) Avail: NTIS CSCL 12/1

Let x(t) be a Levy process with x(0) = 0, and M(t) = sup(x(s) (0 < or s t)), m(t) = inf(X(s) (0 < s or = s < or t) Recent work has revealed several interesting properties of the two processes M - X and X - m. The inverse of the local time at zero of each of these processes is a subordinator. It turns out that both these subordinators have nonzero drifts if and only X is a compound Poisson process with zero drift. In all other cases if one subordinator has a nonzero drift, then the other is a compound Poisson with zero drift, and if both subordinators have zero drifts. Then neither can be a compound Poisson. In the case where one of them (say the one corresponding to M - X) has a nonzero drift, the family of events (M(t) - X(t) = 0) is a standard regenerative phenomenon. If it has zero drift then one speaks of a 'fictitious' regenerative phenomenon. Examples of storage models are presented in which real as well as fictitious regenerative phenomena occur. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-30026*# Stanford Univ., Calif.
MATERIALS RESEARCH AT STANFORD UNIVERSITY Annual Report, 1 Jul. 1975 - 30 Jun. 1976
30 Jun. 1976 411 p refs Sponsored in part by NASA
(Grant NSF DMR-72-03022)
(NASA-CR-148579; CMR-76-8; AR-15) Avail: NTIS HC $11.00 CSCL 05A

Information briefly describing the total research activity related to the science of materials is reported. Emphasis is placed on physical and mechanical properties of composite materials, energy transportation, superconductors, microwave electronics, and solid state electrochemistry. B.B.

N76-30027# Watervliet Arsenal, N.Y.
INSTABILITY OF A QUASI-DYNAMIC SYSTEM SUBJECTED TO A CIRCULATORY FORCE
G. L. Anderson Jan. 1976 57 p refs
(AD-A022349; WVT-TR-76004) Avail: NTIS CSCL 20/11

The state of stability of a double pendulum consisting of two viscoelastically hinged weightless, rigid bars carrying only a single concentrated mass and subjected to a circulatory and some conservative forces is examined. In the absence of damping in its hinges, this system, which is an example of a quasi-dynamic system, possesses multiple regions of stability and instability and can become unstable through divergence only. It is shown that the state of divergence may be attained whenever the natural frequency of the system either vanishes or becomes infinite. When damping is present in its hinges, the system becomes unstable through either divergence characterized by a vanishing frequency or by flutter. For very slight damping, the value of the critical flutter load is less than that of the critical load of divergence whose onset is characterized by an infinite frequency in the associated non-dissipative system. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-30028*# Lockheed-Georgia Co., Marietta.
DUCT WALL IMPEDANCE CONTROL AS AN ADVANCED CONCEPT FOR ACOUSTIC IMPRESSION Final Report
Peter D. Dean and Brian J. Tester Nov. 1975 364 p refs
(Contract NAS3-18554)
(NASA-CR-134998; LG76ER0132) Avail: NTIS HC $10.50 CSCL 20A

Models and tests on an acoustic duct liner system which has the property of controlled-variable acoustic impedance are described. This is achieved by a novel concept which uses the effect of steady air flow through a multi-layer, locally reacting, resonaunt-cavity absorber. The scope of this work was limited to a 'proof of concept.' The test of the concept was implemented by means of a small-scale, square-section flow duct facility designed specifically for acoustic measurements, with one side of the duct acoustically lined. The test liners were designed with the aid of previously established duct acoustic theory and a semi-empirical impedance model of the liner system. Over the limited range tested, the liner behaved primarily as predicted, exhibiting significant changes in resistance and reactance, thus providing the necessary concept validation. Author

N76-30029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FEASIBILITY OF MAKING SOUND POWER MEASUREMENTS IN THE NASA LANGLEY V/STOL TUNNEL TEST SECTION
Thomas F. Brooks, James Scheiman, and Richard J. Silcox 28 Jul. 1976 40 p refs
(NASA-TM-X-73934) Avail: NTIS HC $4.00 CSCL 20A

Based on exploratory acoustic measurements in Langley's V/STOL wind tunnel, recommendations are made on the methodology for making sound power measurements of aircraft components in the closed tunnel test section. During airflow, tunnel self-noise and microphone flow-induced noise place restrictions on the amplitude and spectrum of the sound source to be measured. Models of aircraft components with high sound level sources, such as thrust engines and powered lift systems, seem likely candidates for acoustic testing. Author

N76-30030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF CROSS-SPECTRAL AND SIGNAL ENHANCEMENT METHODS FOR MAPPING STEADY-STATE ACOUSTIC FIELDS IN TURBOMACHINERY DUCTS
J. W. Posey Aug. 1976 14 p refs Presented at the 91st Meeting of the Acoustical Soc. of Am., Washington, D. C., Apr. 1976
(NASA-TM-X-73916) Avail: NTIS HC $3.50 CSCL 20A

The conceptual differences between the following two approaches used to measure spatial variations in steady-state acoustic pressure amplitude were examined: taking the cross spectrum between two signals from probes in the same field or taking the difference in complex Fourier transform of enhanced probe signals. Each approach is used to analyze pressure data from the inlets of two different turbomachines. A complete mapping of this steady-state field may then be used to determine its modal content. A problem with long term nonstationarity was found with both methods. Conditions for equivalence of the two methods are discussed. Author

N76-30031*# Lockheed-Georgia Co., Marietta.
EFFECTS OF FORWARD VELOCITY ON TURBULENT JET MIXING NOISE Final Report
Harry E. Plumblee, Jr., ed. Washington NASA Jul. 1976 389 p refs
(Contract NAS3-18540)
(NASA-CR-2702) Avail: NTIS HC $10.75 CSCL 20A

Flight simulation experiments were conducted in an anechoic free jet facility over a broad range of model and free jet velocities.

The resulting scaling laws were in close agreement with scaling laws derived from theoretical and semiempirical considerations. Additionally, measurements of the flow structure of jets were made in a wind tunnel by using a laser velocimeter. These tests were conducted to describe the effects of velocity ratio and jet exit Mach number on the development of a jet in a coflowing stream. These turbulence measurements and a simplified Lighthill radiation model were used in predicting the variation in radiated noise at 90 deg to the jet axis with velocity ratio. Finally, the influence of forward motion on flow-acoustic interactions was examined through a reinterpretation of the 'static' numerical solutions to the Lilley equation. Author

N76-30032# Naval Surface Weapons Center, Dahlgren, Va.
AN EXPERIMENTAL STUDY OF SOUND TRANSMISSION FROM AIR INTO BUBBLY WATER
Bruce Maccabee Jul. 1975 75 p refs
(AD-A021422; NSWC/WOL/TR-75-69) Avail: NTIS CSCL 20/1

Sound transmission from air into water in the long wavelength limit is enhanced by the presence of large concentrations of small bubbles. Simple acoustic theory shows that considerable enhancement can take place because the bubbles lower the acoustic impedance of the water and thus decrease the impedance mismatch between air and water. However, impedance matching cannot totally account for the very large increases in acoustic pressure that have been observed in laboratory experiments in a simple hydroacoustic tank (not acoustically damped). In these experiments, sound pressures measured near the apex of a conical shaped bubbly region (apex at its bottom) have been found to be as much as two orders of magnitude greater, at certain frequencies, than pressures measured at the same place in the tank in the absence of bubbles. GRA

N76-30033# ENSCO, Inc., Springfield, Va.
ACOUSTIC SCATTERING Final Report, 15 Mar. - 31 Oct. 1975
W. Hernandez and Jimmy Jacobs 27 Feb. 1976 26 p
(Contract N00014-75-C-1025)
(AD-A021456; FR-1) Avail: NTIS CSCL 20/1

Signal processing techniques are developed which detect the presence on non-linear angular modulation sidebands of an acoustic signal. The ocean acoustic signal is modulated in this manner by the scattering from the stochastically moving, low frequency ocean surface. GRA

N76-30034# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
NOISE HAZARD EVALUATION SOUND LEVEL DATA ON NOISE SOURCES
Jeffrey Goldstein Jan. 1975 60 p refs
(AD-A021465) Avail: NTIS CSCL 06/10

The technical guide was developed as an aid and simplification of the noise hazard assessment element of the installation hearing conservation program. Part I of the technical guide provides the reader with basic information necessary for the conduct of a routine occupational noise hazard evaluation, while part II provides additional information and guidance concerning typical personnel exposures to military noise sources. GRA

N76-30035# Naval Research Lab., Washington, D.C.
AN UNDERWATER ACOUSTIC SOURCE FOR THE INFRASONIC AND LOW-AUDIO-FREQUENCY RANGE (USRD TYPE J13 TRANSDUCER) Final Report
A. Mark Young 30 Dec. 1975 22 p refs
(NRL Proj. S02-31; RF11121403)
(AD-A020511; NRL-7967) Avail: NTIS CSCL 17/1

An electrodynamically driven underwater sound source with an acoutic output of 1.349 W has been developed. Adapted in various configurations including as many as nine driving units, this transducer fulfills a substantial portion of the needs for low-audio-frequency underwater sound sources. Author (GRA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-30036# Chicago Univ., Ill.
BASIC STUDIES OF ATOMIC DYNAMICS Progress Report, 1 Oct. 1974 - 30 Sep. 1975
1 Oct. 1975 9 p refs
(Contract E(11-1)-1674)
(COO-1674-113) Avail: NTIS HC $4.50

Topics covered include: fitting many body theories into the theory of atomic spectra and collisions; variation of atomic properties along the periodic system; angular distribution of collision products (electron-atom collisions); application of atomic points of view to crystal lattice phenomena; and double photoionization of neon. NSA

N76-30037# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
AQUEOUS HALOGEN EQUILIBRIA CASE. 1: HALOGEN IN PURE WATER Technical Report, Aug. 1974 - Aug. 1975
David H. Rosenblatt, Eugene P. Meier, and Mitchell J. Small Nov. 1975 52 p refs
(DA Proj. 3A7-62720-A-835)
(AD-A020667; TR-7506) Avail: NTIS CSCL 07/4

A 'Master Equation' is derived for the exact determination of the concentrations of halogen species formed when elemental chlorine, bromine or iodine have been added to a water containing no interacting substances. The solutions to this equation apply only to equilibrium conditions and are only as exact as the equilibrium constants used in the calculations. Simplified lower order equations are also derived for such determinations where known boundary conditions exist. Logic diagrams are presented for the solution of 'Master Equation' with the aid of a computer or a programmable calculator. A program is presented for solving the 'Master Equation' on the Hewlett-Packard 9830A Calculator. Author (GRA)

N76-30038# Harry Diamond Labs., Adelphi, Md.
OPTICAL SPECTRA AND ANALYSIS OF Pr(3+) IN CaWO4
Donald E. Wortman, Clyde A. Morrison, and Richard P. Leavitt Nov. 1975 13 p refs
(DA Proj. 1T1-61102-A-34A)
(AD-A020721; HDL-TR-1726) Avail: NTIS CSCL 07/4

Optical absorption and fluorescence data were studied for the 4f(2) configuration of Pr(3+) in CaWO4. The absorption spectrum was recorded over the wavelength region from 0.3 to 2.5 micrometers at crystal temperatures of 25 and 85 K. The crystals were grown from a melt containing 1.0 atomic percent Pr(3+). These absorption data were correlated with reported fluorescence data to establish energy levels in all the terms, except the singlet S corresponding theoretical levels were obtained by diagonalizing a Hamiltonian containing the free-ion and crystal-field interactions in a basis of states spanning the ground configuration. A least-rms deviation of 18.3/cm between measured and calculated energy levels was obtained by varying the parameters of this Hamiltonian. Calculated g factors were also obtained for the energy degenerate doublets. GRA

N76-30039# Toronto Univ. (Ontario). Dept. of Chemistry.
KINETICS OF ASSOCIATION-DISSOCIATION REACTIONS AND ENERGY TRANSFER IN DIATOMIC MOLECULES Final Scientific Report
George Burns 12 Jan. 1976 21 p
(Contract AF-AFOSR-2620-74; AF Proj. 9538)
(AD-A020759; AFOSR-76-0105TR) Avail: NTIS CSCL 07/4

Recombination of atoms into diatomic molecules and dissociation of diatomic molecules was studied over a wide temperature range, using flash photolysis and shock wave techniques. The experimental results were interpreted using classical trajectory calculation method and the agreement between the theory and experiment was found to be good. Additional experiments and calculations, to back-up the above work were performed. Author (GRA)

N76-30040# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
INTERACTION OF MONATOMIC AND DIATOMIC MOLECULES WITH SOLID SURFACES Final Report, 1 Oct. 1970 - 30 Sep. 1975
Leon Trilling and H. Y. Washman Oct. 1975 16 p refs
(Contract F44620-71-C-0006; AF Proj. 6813; AF Proj. 9781)
(AD-A020592; AFOSR-76-0005TR) Avail: NTIS CSCL 07/4

A research program into phenomena related to gas-surface interaction was conducted over the last several years with the broad objective of answering the following general question: Given a stream of gas molecules of known properties approaching a specified surface, how does one predict the velocity and flux distributions of the streams which leave the surface. Beginning with very simple configurations, account has been taken of an increasingly detailed extended set of properties of the solid surface, of the gas stream and of the interaction process. The basic problem was formulated with a view to understanding molecular transport phenomena, first on inert metallic surfaces such as the skins of satellite vehicles in orbital flight, and later on ice crystals and nucleating centers in Brownian motion in the upper atmosphere. The experimental work during the present contract period included the development of a new scheme for measuring molecular velocity distribution using velocity spectrometry of electron beam excited metastable species. In the theoretical part of this research, a classical continuum model of the surface was constructed which successfully allows for a number of physical effects that are not predicted by lattice models. GRA

N76-30041# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE NATURAL LINE SHAPE OF THE GIANT DIPOLE RESONANCE M.S. Thesis
Edward Franklin Gordon Dec. 1975 72 p refs
(AD-A021831) Avail: NTIS CSCL 20/8

An investigation of photoabsorption experiments in the spherical nucleus (141)pr, the quasispherical dynamically deformed (197)Au, and the statically deformed (165)Ho showed that the best function for the energy dependence of the reduced transition probability is given by the Breit-Wigner form rather than the Lorentz form of a resonance function. However, the form of the resulting measured cross section is of the Lorentz type. The dependence of the giant resonance width Gamma on the excitation energy was also investigated. The variation was found to be less than 1% per MeV if one considered the known isovector E2 resonances above the giant dipole resonance. Best fit values of the reduced transition probabilities for the three nuclei are given and compared to (e, e') results. GRA

N76-30042# Fritz-Haber-Institut, Max-Planck-Gesellschaft, Berlin-Dahlem (West Germany).
COMPTON X-RAY SCATTERING Final Technical Report, Jul. - Dec. 1975
R. Hosemann, A. Muller, and J. Urban Dec. 1975 18 p
(Contract DA-ERO-124-74-G0045;
DA Proj. 2O0-61102-B-11B)
(AD-A021433) Avail: NTIS CSCL 18/4

The new high precision Fluorescence Compton line profile equipment provides a more detailed study of the investigation of the Compton effect by means of Compton Fluorescence Scattering (CFS). One important progress is the monochromatic fluorescence radiation, the other, the high signal to noise ratio, which for LiF 200 analyzer is 30 times better and for LiF 600 4 times better than with the conventional method. GRA

N76-29831 Clarkson Coll. of Technology, Potsdam, N.Y.
FLUORESCENT AND RAMAN SCATTERING IN PARTICLES
M. Kerker, P. J. McNulty, and H. Chew *In* AGARD Opt. Propagation in the Atmosphere May 1976 8 p refs (For availability see N76-29815 20-46)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N76-30043# Rochester Univ., N.Y.
NUCLEAR STRUCTURE RESEARCH LABORATORY Annual Report, 1975
1975 232 p refs Sponsored by NSF
Avail: NTIS HC $8.00

Considerable emphasis in the experimental program continues on alpha transfer reaction mechanisms and alpha widths of nuclear levels utilizing the reactions (L1-6,d) and (O-16,c-12). In connection with the latter reaction, an interesting comparison was made between alpha decay and alpha transfer in the lead region. The heavy ion detector for the focal plane of the split pole magnetic spectrometer was further refined. In particular, a survey was begun on reactions induced by Na-23 on Si-28. Other areas of research involved heavy ion beams in measurements of excited state quadrupole moments; continuing measurements on highly damped collision processes; and fusion, fission and elastic scattering studies. Author

N76-30044*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORETICAL L-SHELL COSTER-KRONIG ENERGIES 11 > OR EQUAL TO Z > OR EQUAL TO 103
Mau Hsiung Chen (Oregon Univ.), Bernd Crasemann (Oregon Univ.), Keh-Ning Huang (Oregon Univ.), Michio Aoyagi, and Hans Mark [1976] 71 p refs
(Grants NGR-38-003-036; DAHC04-75-G-0021)
(NASA-TM-X-74159) Avail: NTIS HC $4.50 CSCL 20H

Relativistic relaxed-orbital calculations of L-shell Coster-Kronig transition energies have been performed for all possible transitions in atoms with atomic numbers. Hartree-Fock-Slater wave functions served as zeroth-order eigenfunctions to compute the expectation of the total Hamiltonian. A first-order approximation to the local approximation was thus included. Quantum-electrodynamic corrections were made. Each transition energy was computed as the difference between results of separate self-consistent-field calculations for the initial, singly ionized state and the final two-hole state. The following quantities are listed: total transition energy, 'electric' (Dirac-Hartree-Fock-Slater) contribution, magnetic and retardation contributions, and contributions due to vacuum polarization and self energy. Author

N76-30045*# Scientific Translation Service, Santa Barbara, Calif.
ISOTOPIC SHIFT BETWEEN THE EVEN NUMBERED Sr ISOTOPES 84, 86, 88 AND 90 AND THE JUMP IN NUCLEAR VOLUME EFFECT IN THE CASE OF NEUTRON COUNT 50
K. Heilig Washington NASA Aug. 1976 23 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 161, 1961 p 252-266
(Contract NASw-2791)
(NASA-TT-F-17150) Avail: NTIS HC $3.50 CSCL 20H

A recording Fabry-Perot spectrometer was used to investigate enriched isotopes. The isotope displacements of stable 84, 86 and 88 isotopes has the sign of the nuclear mass effect; that of isotope 88 with respect to radioactive 90 isotope has the sign of the nuclear volume effect. The same thing was found for the Sr I resonance line. Author

N76-30046*# United Technologies Research Center, East Hartford, Conn.
PLASMA CORE REACTOR SIMULATIONS USING RF URANIUM SEEDED ARGON DISCHARGES
W. C. Roman Washington NASA Jul. 1976 45 p refs
(Contract NAS1-13291)
(NASA-CR-2719) Avail: NTIS HC $4.00 CSCL 20I

Experimental results are described in which pure uranium hexafluoride was injected into an argon-confined, steady-state, RF-heated plasma to investigate characteristics of plasma core nuclear reactors. The 80 kW (13.56 MHz) and 1.2 MW (5.51 MHz) rf induction heater facilities were used to determine a test chamber flow scheme which offered best uranium

confinement with minimum wall coating. The cylindrical fused-silica test chamber walls were 5.7-cm-ID by 10-cm-long. Test conditions included RF powers of 2-85 kW, chamber pressures of 1-12 atm, and uranium hexafluoride mass-flow rates of 0.005-0.13 g/s. Successful techniques were developed for fluid-mechanical confinement of RF-heated plasmas with pure uranium hexafluoride injection. Author

N76-30047# Instituto Politecnico Nacional, Mexico City.
SOLUTION OF DIFFUSION EQUATIONS FOR VARIOUS GROUPS BY THE FINITE ELEMENT METHOD M.S. Thesis
C. A. Sanchez Jul. 1975 120 p refs
(NP-20592) Avail: ERDA Depository Libraries HC $9.00

A code was implemented to resolve neutron scattering equations in two dimensions, obtained by applying the approximation of various energy groups. The code works with any number of groups and regions and is applicable to both thermal and fast reactors. By supplying the scattering coefficients, the cross sections, and the fission spectrum, it produces the multiplication constant of the system and the fluxes of each group. The code was developed by using the finite element method which is one form of resolving the variational formulation of the equations applying the Ritz-Galerkin method with continuous polynomial functions by parts, in the present case of the Lagrange type with rectangular geometry up to the third order. The results obtained apd the comparison with literature results lead to the conclusion that it is advantageous to use rectangular elements in all cases where the geometry permits it. Author (NSA)

N76-30048# Montpellier Univ. (France). Dept. of Physique Mathematique.
VERY HIGH ENERGY PHYSICS WITH STORAGE RINGS [LA PHYSIQUE AVEC DES ANNEAUX DE TRES HAUTES ENERGIES]
F. M. Renard Jun. 1975 30 p refs In FRENCH; ENGLISH summary Presented at the Soc. Franc. de Phys. Colloq. on Anneaux de Collisions, Dijon, France, 1975
(PM/75/9) Avail: NTIS HC $4.00

The application of storage rings involving collisions between very high energy electrons and/or positrons to the study of leptons and their own interactions was described. The following areas were disicussed: (1) search for heavy leptons or new bosons, (2) study of quantum electrodynamics at short distances and of hadronic and weak corrections, (3) photon-photon collisions and structure of the quasi-real or virtual photons, (4) dynamics of the annihilation between electrons and positrons to give hadrons, (5) the observation of interferences between weak neutral currents and electromagnetic interactions, (6) the study of scaling, in the deep inelastic region, in relation with the fundamental constituents of the hadrons and their asymptotically free interactions, as well as inclusive reactions with a beam of variable mass. Y.J.A.

N76-30049# RAND Corp., Santa Monica, Calif.
COMMENTS ON LMFBR COST-BENEFIT ANALYSIS
Arthur J. Alexander and Donald B. Rice Aug. 1975 22 p refs
(AD-A022296; P-5498) Avail: NTIS CSCL 18/9

This review of the cost-benefit analysis of the LMFBR is in three sections, each of which looks at the issue from a somewhat different perspective. The first section examines several of the most important assumptions and detailed projections which underlie the analysis. Section II reviews the role of cost-benefit analysis as a tool for decisionmaking in the LMFBR case, based on the analysis contained in the PFEIS and on the modifications suggested by our review. Based on a synthesis of these findings, the third section suggests some guides for future policy. GRA

N76-30050# Office of Naval Research, London (England).
APPLICATIONS OF ION BEAMS TO MODIFY THE PROPERTIES OF MATERIALS
E. A. Wolicki, J. W. Butler, K. L. Dunning, and J. K. Hirvonen 27 Jan. 1976 12 p Presented at The Conf. on Appl. of Ion Beams to Mater., Univ. of Warwick, Eng., 8-12 Sep. 1975
(AD-A021653; ONRL-C-3-76) Avail: NTIS CSCL 05/2

Ion implantation can modify the properties of materials by changing their electrical, optical, chemical or mechanical properties, and this technique is already in commercial use for production of semiconductor devices. The 65 papers presented at the conference on 'Applications of Ion Beams to Materials' (U. of Warwick, 8-12 Sept 1975) covered the applications of ion beams to semiconductors, insulators, and metals and included studies of radiation damage. All these aspects of the conference proceedings are summarized in this report, which also contains background material for the non-specialist.
Author (GRA)

N76-30051# Tel-Aviv Univ. (Israel).
GENERALIZED APPROXIMATIVE PROCEDURES IN THE MANY BODY PROBLEM, 3 Final Report
I. Kelson Oct. 1975 41 p refs
(Grant DA-ERO-75-G-031)
(AD-A022432) Avail: NTIS CSCL 20/8

The generalized Hartree-Fock approach leads to computational problems which need special treatment. In particular, expansion methods are proposed for the calculation of matrix elements between states in different single particle representations, rotated or deformed relative to each other. Special numerical examples are carried out, as well as a definite application: the projection of the lowest state in a rotational band, using the discrete point configuration method. GRA

N76-30052# Naval Research Lab., Washington, D.C.
ENERGY MOMENT METHOD FOR STRAGGLING OF AN ULTRA-RELATIVISTIC ELECTRON BEAM Interim Report
Martin Lampe Feb. 1976 18 p refs
(NRL Proj. R08-83)
(AD-A021980; NRL-MR-3221) Avail: NTIS CSCL 20/8

High energy electrons propagating in matter are subject to energy loss due to single particle interactions, i.e. bremsstrahlung radiation and ionizing collisions with ambient atoms. In addition, if the electrons propagate in a high current beam, inductive electric fields arising from the current changes at the front and rear of the beam pulse can have a significant retarding effect on the beam electrons (energy extracted in this way can be dissipated resistively in currents driven in the ambient medium; in some cases, some of the energy goes into accelerating electrons at the pulse tail). As a result of these three mechanisms, the mean energy of propagating electrons falls off, and an energy spread develops. In general, one can define an energy spectrum f(E, t), as a function of propagation distance t. GRA

74 OPTICS

Includes light phenomena.

N76-30053* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLARIZATION COMPENSATOR FOR OPTICAL COMMUNICATIONS Patent
Michael W. Fitzmaurice and James B. Abshire, inventors (to NASA) Issued 27 Jul. 1976 8 p Filed 24 Apr. 1974 Supersedes N74-22827 (12-14, p 1648)
(NASA-Case-GSC-11782-1; US-Patent-3,971,930; US-Patent-Appl-SN-463925; US-Patent-Class-250-199) Avail: US Patent Office CSCL 20F

An optical data communication system is provided whereby two orthogonal polarization states of a light beam carrier correspond to digital states. In such a system, automatic polarization compensation is provided by applying a dither modulating voltage to a cell exhibiting the electro-optic effect. The cell controls the relative phase of electric field components of an input light beam enabling the dither frequency component of the difference of the instantaneous powers in the two polarization states to be coherently detected. A signal derived from the coherent detection process is fed back to the cell via an integrator to form polarization bias compensating servo loop ot Type 1. Official Gazette of the U.S. Patent Office

N76-30054*# Scientific Translation Service, Santa Barbara, Calif.
THEORY OF THE ANISOTROPIC EFFECTS BETWEEN CROSSED NICOLS IN REFLECTED LIGHT
M. Berek Washington NASA Aug. 1976 19 p refs Transl. into ENGLISH from Z. Kristallogr. (West Germany), v.89, 1934 p 144-155

(Contract NASw-2791)
(NASA-TT-F-17172) Avail: NTIS HC $3.50 CSCL 20F

The anticipated occurrences of pure and modified anisotropic effects in reflected light are developed on the basis of theory.
Author

N76-30055# RAND Corp., Santa Monica, Calif.
FAR INFRARED AND SUBMILLIMETER WAVE ATTENUATION BY CLOUDS AND RAIN
D. Deirmendjian Apr. 1975 40 p refs
(AD-A021947; P-5419) Avail: NTIS CSCL 20/6

Newly determined optical constants for water at far infrared and submillimeter wavelengths are used to estimate water cloud and rain attenuation over the wavelength range between 12 micrometers and 2cm. For this purpose new analytic dropsize distribution models simulating fog, nimbostratus cloud, and rain corresponding to rainfall rates of 10 and 50 mm per hr. are set up. The corresponding volume extinction and absorption coefficients are computed according to polydisperse Mie scattering theory at specific wavelengths and presented in tables and graphically in plots for purposes of interpolation. It is found that cloud extinction may exceed 50 nepers per kilometer in the wavelength region less than or approximately equal to 100 micrometers region whereas for wavelengths longer than 200 micrometers, under near saturated conditions, water vapor absorption should be the dominant attenuator. The results also suggest that, in the presence of non-precipitating water clouds or fog there may be a relative transmission 'window' centered around wavelength 1.3 mm. GRA

N76-30056# Rome Air Development Center, Griffiss AFB, N.Y.
AMOS (ARPA MAUI OPTICAL STATION) SEEING QUALITY MEASUREMENTS
Darryl P. Greenwood, Donald O. Tarazano, Duane A. Haugen (AFCRL), Paul F. Kellen (Avco-Everett Res. Lab., Everett, Mass.), Merlin G. Miller (Avco-Everett Res. Lab., Everett, Mass.), Jim Newman (AFCRL), and J. Chandran Kaimal (AFCRL) Jan. 1976 80 p refs
(ARPA Order 2646)
(AD-A021943; RADC-TR-75-295) Avail: NTIS CSCL 20/6

During the month of August 1974, a series of experiments was conducted at the ARPA Maui Optical Station (AMOS) on Mt. Haleakala, Maui, Hawaii. The objectives were to quantify astronomical seeing conditions, and to determine if the seeing quality has been degraded by the presence of the site structures. Instruments used were an acoustic sounder (to probe the altitudes of 100 to 1000 ft), finewire microthermal probes (to measure local turbulence in and around the domes) and a Hartmann sensor (to provide integrated strengths of turbulence for the entire atmosphere). According to fine-wire probe data, local turbulence can be on occasion a significant factor in degrading seeing. These sensors noted some thermal contamination from one of the domes which was in a nearly operational configuration. The acoustic sounder indicated that the strengths of turbulence in 100 to 1000 ft altitude are not sufficient to degrade seeing. Finally, the Hartmann device recorded significantly more degradation than was seen by either of the other two probes. It is speculated that there is significant turbulence at high altitude temperature inversions such as at the tropopause.
GRA

N76-30057# Defence Research Establishment Ottawa (Ontario).
THE DYNARAD MODEL 209A FAST SCAN INFRARED CAMERA
D. J. Hidson Jan. 1976 38 p refs
(AD-A021535; DREO-TN-75-29) Avail: NTIS CSCL 17/5

The mode of operation and control features of the Dynarad Model 209A Fast Scan Infrared Camera are described. A series of thermograms are presented to illustrate the capabilities of the infrared camera. This paper is intended to provide background information on experimental techniques used in studies of clothing systems. GRA

N76-30058# Naval Research Lab., Washington, D.C.
REPLICA TECHNIQUES FOR TRANSMISSION ELECTRON MICROSCOPY Interim Report
S. M. McCoy Feb. 1976 29 p ref
(NRL Proj. M01-08; WR02201001)
(AD-A021891; NRL-MR-3220) Avail: NTIS CSCL 20/6

This report concentrates solely on the description of variations in replicating procedures for the transmission electron microscope. It includes techniques for cellulose acetate and direct carbon replication for rough and flat fracture surfaces, collodion dry stripped replicas of polished and etched or flat fracture surfaces, preparation of substrate films on grids for particle examination, and variations in replica wash techniques (i.e., 'fishing'; reflux unit; screen-bridge; and also wax techniques for replicas which tend to fragment badly). The appendix includes material on minimization of artifacts produced during replica preparation, salvage of scrolled replicas, edge retention during replication, and stereo effects. Throughout the text, variations in technique are discussed in order to guide the reader in the selection of an appropriate method to prepare replicas of a given structure. A variety of specialized procedures and detailed explanations are included as well as suggested replicating utensils for basic and specialized techniques. Author (GRA)

N76-30059# Frankford Arsenal, Philadelphia, Pa.
FABRICATION TECHNIQUES FOR FIBER OPTIC FIRE CONTROL ELEMENTS
Ronald L. Springfield Apr. 1975 35 p refs
(AD-A021885; FA-TR-75016) Avail: NTIS CSCL 20/6

This report summarizes the results of a project which was conducted to establish improved manufacturing methods and procedures for the processing of fiber optic blanks (plano-plano surfaces) and fiber optic faceplates (plano convex and plano-concave surfaces). Conventional processes for polishing glass frequently produce scratches, pits, and other defects in fiber optic elements. The fiber optic elements were successfully manufactured using the described processes. GRA

N76-30060# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MEAN AND VARIANCE OF THE IRRADIANCE FOR A PHASE-COMPENSATED OPTICAL LINK IN TURBULENCE Physical Science Research Papers
Ronald L. Fante 18 Nov. 1975 26 p refs
(AF Proj. 6813)
(AD-A021894; AFCRL-TR-75-0591; AFCRL-PSRP-652) Avail: NTIS CSCL 20/6

In the last several years considerable progress has been made toward the development of adaptive systems which can compensate for the deleterious effect of atmospheric turbulence on air/air and air/ground optical communications links. One promising method is reciprocity tracking in which a beacon located on the receiver is used in real time to adjust the wavefront of the transmitter. A beacon signal is emitted at x and the phase distribution of this signal is sensed in the plane $x = 0$. The phase of the transmitter field is then continuously adjusted so that it is the negative of the received beacon phase distribution. Because of atmospheric reciprocity, this then continuously compensates for the phase fluctuations induced on the transmitted field by the turbulent medium between the transmitter and receiver. GRA

N76-30061# Hughes Research Labs., Malibu, Calif.
HYDRAULIC ACTUATORS FOR ACTIVE OPTICAL SYSTEMS Final Technical Report, 1 Oct. 1974 - 22 Jun. 1975
S. Hansen Aug. 1975 46 p refs
(Contract N60921-75-C-0067)
(AD-A021746) Avail: NTIS CSCL 17/8

A fast response, high accuracy, compact hydraulic actuator has been developed and demonstrated for applications that require actuators providing moderate speed, high force, and large optical path length excursions, e.g., as a mirror driver in an adaptive optical system. The actuator is characterized by a -3 dB response bandwidth of 670 Hz when operated at a supply pressure of 3,000 psi, and a total excursion of 42.4 micrometers, which corresponds to plus or minus 4 wavelengths of phase shift at 10.6 micrometers when used as a mirror driver. The actuator was tested in a deformable faceplate fixture that simulates nine actuator positions at a modular spacing of 2 cm (0.8 in.). Plots are given of measured mirror surface profiles and contours. A computed contour plot is given for comparison. Also included is a program for computer simulation of the actuator in a complete multichannel, multidither COAT control system. GRA

N76-30062# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
SAPPHIRE FIBER TRANSMISSION AT TEMPERATURES UP TO 1000 F Final Technical Report, Sep. 1974 - Mar. 1975
James Edward Hamant Oct. 1975 50 p refs
(AF Proj. 3048)
(AD-A022373; AFAPL-TR-75-48) Avail: NTIS CSCL 20/6

An optically clear sapphire fiber was subjected to increased temperatures up to 1,000 F to determine the change in percent transmission. The transmission was measured in two regions of the optical spectrum: the ultraviolet region from 235 nanometers to 365 nanometers, and the visible region from 4,100 Angstroms to 6,500 Angstroms. The percent transmission of the fiber decreased with increasing temperature. As the wavelength increased the effect of a temperature increase was less.
Author (GRA)

N76-30063# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
FIBER OPTIC WAVEGUIDES BY MOLECULAR STUFFING Progress Report
P. B. Macedo, T. A. Litovitz, C. T. Moynihan, C. J. Montrose, R. K. Mohr, and J. H. Simmons Dec. 1975 49 p
(Contract N00019-75-C-0083)
(AD-A022273) Avail: NTIS CSCL 20/6

The research program to develop low loss glass fiber optic waveguides involves a novel technique called 'Molecular Stuffing,' which may be used to produce any desired index profile in a porous glass preform such as the phasil rods developed in our laboratory. The nature of this process is such that relatively inexpensive raw materials may be used as starting materials. The purification steps which result in an ultrapure glass preform are done in such a manner that costly clean room procedures are avoided and glass production and processing can be done at relatively low temperatures. This process thus offers an alternative to ultrapure glass melting or chemical vapor deposition which require costly processing procedures and/or raw materials. A further characteristic of Molecular Stuffing is that it is possible to produce high numerical aperture step or parabolic index profiles. During this year considerable progress has been made in defining the criteria for obtaining dopants to be used in the Molecular Stuffing process. In this respect the results of the work are presented in terms of a description of the Molecular Stuffing procedure as it exists at this time. GRA

N76-30064# Battelle Columbus Labs., Ohio.
LARGE-ANGLE SWITCHING IN PLANAR OPTICAL WAVEGUIDES Final Report, 1 Jan. - 31 Dec. 1975
Richard P. Kenan 31 Dec. 1975 55 p refs
(Contract N00014-75-C-0591; NR Proj. 215-236)
(AD-A022020) Avail: NTIS CSCL 20/6

This program resulted in the production of a laboratory model of a large-angle optical waveguide switch which is the first stage in the development of a switching element to perform the interconnect function in a fiber-optic communication system. The switch is composed of a thick phase grating in a planar waveguide and and electro-optic element which can alter the grating condition or the angle of incidence of the signal beam upon the grating. It is thus possible to switch from an arbitrarily large predetermined deflection angle to a condition of no deflection. The gratings are formed by a holographic process at the region of intersection of two guided waves in a LiNbO3 Ti waveguide. Diffraction efficiencies of over 80% have been achieved in unfixed gratings, i.e. gratings which fade with time constant of several hours. Procedures are being developed for fixing gratings, and diffraction efficiencies of over 25% have been achieved with these nondegradable gratings. Electrode structures capable of 92% intensity modulation of the diffracted beam have been developed. Methods for improving both the diffraction efficiency and the modulation depth are suggested.
Author (GRA)

N76-30065# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
OPTICAL MATERIALS CHARACTERIZATION Semiannual Technical Report, 1 Aug. 1975 - 31 Jan. 1976
Albert Feldman, Deane Horowitz, Roy M. Waxler, Irving H. Malitson, and Marilyn J. Dodge Feb. 1976 27 p refs
(ARPA Order 2620)
(AD-A022027; NBSIR-76-1010) Avail: NTIS CSCL 11/7

Refractive index and the photoelastic constants have been measured on specimens of reactive atmosphere processed (RAP) potassium chloride and KCl nominally doped with 1% potassium compounds iodine. The refractive indices were measured by the minimum deviation method in the wavelength range 0.25 micrometer to 15.5 micrometers. Measurements were made near 20 C and near 34 C on the RAP specimen and near 20 C on the doped specimen. Each set of experimental data was fitted to a three term Sellmeier-type dispersion equation. The temperature coefficient of index was then computed for the RAP KCl. The data for the different types of KCl were compared to each other and to earlier reported data on commercial KCl. The piezo-optical constants q sub 11, q sub 12 and q sub 44 and the elasto-optical constants p sub 11, p sub 12 and p sub 44 were obtained at 10.6 micrometers for the RAP and doped KCl. The measurements required the use of a modified Twyman-Green interferometer capable of measuring fringe shifts approximately .002 of a wave. Within experimental error the coefficients of the two materials agree. Negligible dispersion was found for q sub 11, q sub 12, p sub 11 and p sub 12 between the visible and 10.6 micrometers while a small dispersion was found for q sub 44 and p sub 44. GRA

N76-30066# Naval Research Lab., Washington, D.C.
NRL'S OCEANOGRAPHIC COMPUTER SYSTEM: PRESENT CAPABILITY AND FUTURE ENHANCEMENTS Interim Report
Daniel Steiger and J. Dean Clamons Feb. 1976 20 p refs
(NRL Proj. Z00-01z)
(AD-A021972; NRL-MR-3216) Avail: NTIS CSCL 20/6

NRL in the past 2 years has developed three oceanographic computers systems. The computer systems are based around Hewlett-Packard 2100 Series computers. The software used is a Real-Time Executive with multiprogramming and multiuser capabilities. NRL's philosophy has been to acquire and process the data in the field automatically, in real time, using the oceanographic computer systems. To accomplish this goal, much attention has been placed upon the interfacing of special-purpose as well as general-purpose devices to the computer system. Many special-purpose devices have already been interfaced to the computer system, such as navigation equipment, ship sensors, aircraft sensors, atmospheric sensors, and magnetometers. General-purpose devices such as random access disks and digital magnetic tapes have been provided in order to access and save the data. Also, several graphical plotting devices are available, including a large flatbed plotter along with displays and line printers to obtain and view the results. A special Fourier analyzer that works in conjunction with a dedicated HP2100 computer is used when real-time and off-line spectrum analysis is required. The oceanographic computer systems have been operated aboard ship and in aircraft alike. GRA

N76-30067# National Bureau of Standards, Washington, D.C. Center for Building Technology.
ELECTRO-OPTICAL DEFLECTION MEASURING DEVICE Final Report, 1972 - 1973
R. A. Crist, R. D. Marshall, and H. I. Laursen Dec. 1975 27 p refs
(PB-248912/8; NBS-TN-873) Avail: NTIS HC $4.00 CSCL 20F

The development and testing of an electro-optical device for the direct measurement of lateral deflections of tall structures are described. The device uses a tracking telescope mounted on a fixed reference and a light source attached to the structure of the level for which lateral deflections are to be measured. Operating characteristics of the system are based on the results of tests carried out over a period of several months in one of the elevator shafts of a 12-story building. GRA

N76-30068# Washington Univ., Seattle. Dept. of Mining, Metallurgical, and Ceramic Engineering.
FABRICATION OF LOW-LOSS OPTICAL WAVEGUIDES BY POST DEPOSITION MICROSTRUCTURE MODIFICATION Semiannual Progress Report, 3 Jun. - 3 Dec. 1974
Alan D. Miller and George R. Fosmire 28 Feb. 1975 9 p refs

(Contract N00123-73-C-1200)
(AD-A022069) Avail: NTIS CSCL 20/6

This report summarizes contract progress of investigations into the effects of heat treatment on linear optical waveguide structures made of ferroelectric materials. It is hypothesized that low-loss polycrystalline waveguides may be produced by orienting grain boundaries perpendicular to the waveguide axis by thermo treatment. Using the Hatzakis lift-off technique with electron resist to obtain linear waveguides, lithium tantalate films on Corning 7059 glass slides have been examined. Presently produced lithium tantalate films are lithium deficient. Techniques for improving the stochiometry are being investigated.
Author (GRA)

N76-29833 Defence Research Establishment Valcartier (Quebec).
LOG-NORMAL PROBABILITY DISTRIBUTION OF STRONG IRRADIANCE FLUCTUATIONS: AN ASYMPTOTIC ANALYSIS
Luc R. Bissonnette *In* AGARD Opt. Propagation in the Atmosphere May 1976 10 p refs (For availability see N76-29815 20-46)

N76-29848 Defense Advanced Research Projects Agency, Arlington, Va.
COMPENSATED IMAGING
James W. Justice and Raymond P. Urtz, Jr. (RADC, Griffiss AFB, N. Y.) *In* AGARD Opt. Propagation in the Atmosphere May 1976 17 p refs (For availability see N76-29815 20-46)

N76-29850 California Univ., San Diego.
COMPUTER SIMULATION OF ATMOSPHERIC TURBULENCE AND COMPENSATED IMAGING SYSTEMS
B. L. McGlamery *In* AGARD Opt. Propagation in the Atmosphere May 1976 17 p refs (For availability see N76-29815 20-46)

N76-29851 Optical Science Consultants, Yorba Linda, Calif.
HOW MANY PICTURES DO YOU HAVE TO TAKE TO GET A GOOD ONE?
David L. Fried *In* AGARD Opt. Propagation in the Atmosphere May 1976 11 p refs (For availability see N76-29815 20-46)

N76-29857 Marconi-Elliot Avionic Systems Ltd., Basildon (England).
ATMOSPHERIC LIMITATIONS OF ACTIVE AND PASSIVE NIGHT VISION SYSTEMS
E. G. D. Youngs *In* AGARD Opt. Propagation in the Atmosphere May 1976 7 p refs (For availability see N76-29815 20-46)

N76-29859 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE INFLUENCE OF THE ATMOSPHERE BETWEEN HELICOPTERS AND GROUND-TARGETS ON THE DOWNWARD AND UPWARD VISIBILITY
H.-E. Hoffmann *In* AGARD Opt. Propagation in the Atmosphere May 1976 16 p refs (For availability see N76-29815 20-46)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-30069# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands).
HIGH-FREQUENCY RADIATION FROM STRONG DENSITY FLUCTUATIONS IN A TURBULENT PLASMA
W. R. Rutgers Dec. 1975 13 p refs
(NP-20762) Avail: ERDA Depository Libraries HC $3.50

The spectrum of electromagnetic radiation emitted by a hot hydrogen plasma yields information on nonthermal fluctuations in turbulent heating experiment. Its frequency spectrum contains frequencies below the electron plasma frequency f sub pe during the first half microsecond when plasma turbulence is characterized by streaming instabilities. When after a few microseconds the ion temperature approaches the electron temperature, a current stagnation is observed. Then the spectrum consists of clear maxima at the plasma frequency and its harmonics up to 6 f sub pe. It is demonstrated that radiation can result from strongly anharmonic electron oscillations, which can be as high as sigma n/n 0.4, trapped in long-lived solitary density depressions. Above 5 f sub pe enhanced Bremsstrahlung has to be taken into account.
Author (NSA)

N76-30070# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
EXPERIMENTAL STUDY OF OF 3/2 OMEGA SUB L EMISSION FROM A LASER-PRODUCED PLASMA
K. Eidmann, H. C. Pant, P. Sachsenmaier, and R. Sigel Sep. 1975 15 p refs Presented at the 8th Conf. on Laser Plasma Fussion, Warsaw, 19 May 1975
(IPP-IV-85; Conf-750590-1) Avail: ERDA Depository Libraries HC $3.50

The 3/2 omega sub L emission from various plane targets irradiated by a 20 J/5 ns Neodymium laser pulse was investigated. A threshold as predicted for excitation of the 2 omega sub pe -decay was observed.
Author (NSA)

N76-30071# Princeton Univ., N.J. Plasma Physics Lab.
QUASILINEAR THEORY OF ION-CYCLOTRON RESONANCE HEATING OF PLASMAS AND ASSOCIATED LONGITUDINAL COOLING
V. Arunasalam Feb. 1976 10 p refs
(Contract E(11-1)-3073)
(MATT-1221) Avail: NTIS HC $4.00

It is shown from quasilinear theory that an initially isotropic magnetized plasma will be forced into an anisotropic state in ioncyclotron resonance heating. Strong heating of perpendicular ion temperature and strong cooling of longitudinal temperature should occur simultaneously. The maximum temperature ratio predicted by quasilinear theory is in exact agreement with that predicted from basic thermodynamic arguments by Busnardo-Neto, Dawson, Kamimura and Lin. Heating by fast hydromagnetic wave is also examined.
Author (NSA)

N76-30072# Princeton Univ., N.J. Plasma Physics Lab.
RF HEATING NEAR THE LOWER HYBRID FREQUENCY IN THE FM-1 SPHERATOR
R. J. Hawryluk, S. L. Davis, and J. A. Schmidt Dec. 1975 29 p refs
(Contract E(11-1)-3073)
(MATT-1185) Avail: NTIS HC $4.00

Plasma heating experiments at frequencies near the lower hybrid frequency were carried out at modest power (.05 to 4kW). The antenna structure operating at 68 MHz was comprised of two plates driven out of phase on the exterior of the plasma. High electron heating efficiency (greater than 40 percent) in both helium and argon plasmas was observed with only a weak density dependence. At low densities the heating was uniform across the plasma while at higher densities the heating was preferentially on the exterior portion of the plasma. The heating of the exterior of the plasma was found not to correspond to absorption at the lower hybrid resonance layer. The electron heating efficiency was found to be a weak function of rf power when the incident rf power was varied from 1 to 15 times the experimentally observed threshold power for parametric instabilities. Ion temperatures were determined by measuring the Doppler broadening of an Argon ion line using a Fabry Perot interferometer.
Author (NSA)

N76-30073# Princeton Univ., N.J. Plasma Physics Lab.
POWER AND PHASE MONITORING SYSTEM FOR THE LOWER HYBRID PHASED ARRAY HEATING SYSTEM ON ATC MACHINE
B. W. Reed 1975 20 p refs Presented at the 6th IEEE Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17 Nov. 1975 Sponsored by ERDA
(Conf-751125-116) Avail: NTIS HC $3.50

A four waveguide phased array slow wave structure was constructed to couple microwave energy into plasma in the ATC Tokamak at Princeton. Theory has indicated that the coupling of power into the plasma column is a strong function of the imposed Fourier spectrum at the antenna aperture. To optimize heating, and to verify theoretical results, a precision amplitude and

phase monitoring system was designed and constructed. The system data output is routed to an IBM 1800 computer where the Fourier spectrum in n parallel space is computed for discrete increments of time during an RF pulse. Computer output data is used to update the adjustment of tramsmission line parameters inbetween pulses. Author (NSA)

N76-30074# California Univ., Los Angeles. Plasma Physics Group.
PARAMETRIC EXCITATION OF ION DENSITY FLUCTUATIONS IN THE RELATIVISTIC BEAM-PLASMA INTERACTION
H. Schamel, Y. C. Lee, and G. J. Morales Jan. 1976 42 p refs Sponsored in part by the Max-Planck Gesellschaft and the Deutsche Forschungsgemeinschaft
(Contract N00014-75-C-0476; NSF GP-40983-PJ69)
(AD-A021459; PPG-251) Avail: NTIS CSCL 20/9

When a weak and cold relativistic electron beam interacts with a dense plasma it generates a nearly monochromatic wave of high intensity which triggers the growth of parametric instabilities. The present work investigates this process by using a hybrid technique in which the fully relativistic motion of the beam particles is treated numerically, while the behavior of the background plasma and the parametrically excited waves is treated analytically through appropriate linear dielectric functions. It is found that the self-consistent excitation of large ion density fluctuations leads to the decoupling of the beam from the background plasma, hence limiting the amount of energy that can be extracted from the beam. By adjusting the various parameters of the problem it is found that up to 23% of the initial beam energy can be transferred to the electrostatic waves. The large ion fluctuations responsible for decoupling the beam correspond to purely growing modes which exhibit secular growth in time. GRA

N76-30075# ARO, Inc., Arnold Air Force Station, Tenn.
COMPARISON OF ELECTRON-ION RECOMBINATION AND GAS-DYNAMIC EXPANSION RATES IN FREELY EXPANDING HELIUM AND ARGON PLASMAS Interim Report, 1 Jul. 1973 - 30 Jun. 1975
L. H. Malone (Tenn. Univ.) and C. C. Limbaugh AEDC Mar. 1976 54 p refs
(AD-A021958; ARO-ETF-TR-75-114; AEDC-TR-76-34) Avail: NTIS CSCL 20/9

Equations coupling the collisional-radiative recombination and gas-dynamic phenomena for the centerline of the freely expanding plume of an argon and helium arcjet are developed and solved for the free electron density. The results of these calculations are used to ascertain the time rates of change of the free electron density attributable to the recombination and gas-dynamic processes separately. Experimental data are presented which support the conclusions drawn from the analytical results. Therefore, based on these results, a more detailed approach than the collisional-radiative recombination model is necessary for the correct description of recombination mechanisms in the rapidly changing environment of the expanding arcjet plume. GRA

N76-30076# Texas Univ., Austin. Fusion Research Center.
DIAGNOSTIC STUDIES OF TURBULENT HEATING IN THE TEXAS TURBULENT TORUS AND THE RELEVANCE OF TURBULENT HEATING TO FUSION EXPERIMENTS AND REACTORS Final Report
William E. Drummond Dec. 1975 75 p refs Sponsored by the Elec. Power Res. Inst.
(PB-251516/1; EPRI-96-3-FR) Avail: NTIS HC $4.50 CSCL 18A

Work on the turbulent heating studies, data acquisition and processing system, with details of the experiments are reported. Conclusions and the present view of the potential of turbulent heating for fusion studies are also included. Author (GRA)

N76-30077# Air Force Academy, Colo. Frank J. Seiler Research Lab.
A FUNDAMENTAL INVESTIGATION OF THE IONIZATION PROCESS IN XENON UNDERGOING A NORMAL SHOCK WAVE COMPRESSION IN A SHOCK TUBE Final Report
Robert A. Golobic Dec. 1975 58 p refs
(AF Proj. 7905)
(AD-A021776; FJSRL-TR-75-0023) Avail: NTIS CSCL 20/9

The ionization process in xenon has been studied by measurements of the atomic line radiation histories. Visible line radiation measurements of three atomic line transitions resulted in the measurement of time resolved bound electron temperature. No conclusion can be drawn with regard to the non-Boltzmann behavior of the bound states due to the inaccuracies in the reported transition probabilities. Resonance radiation histories are similar to those in the visible. Static pressure profiles clearly define the shock front while total pressure profiles clearly define ionization and test times. Author (GRA)

N76-30078# ARO, Inc., Arnold Air Force Station, Tenn.
TRANSIENT DEVELOPMENT OF EXCITED STATE DENSITIES IN ATOMIC HELIUM PLASMAS Final Report, Oct. 1969 - Apr. 1975
C. C. Limbaugh AEDC Mar. 1976 119 p refs
(AD-A022378; ARO-ETF-TR-75-64; AEDC-TR-76-5) Avail: NTIS CSCL 07/2

The set of detailed rate equations describing the transient decay of singly ionized, constant temperature, constant pressure, monatomic helium plasmas is solved numerically for early times in the plasma decay. These equations, called the eigenstate rate equations, (ERE), have been studied previously for late times in the decay through application of the quasi-steady-state (QSS) assumption and have resulted in the collisional-radiative recombination (CRR) model for description of the electron density decay rate in plasmas. The application of the QSS to the ERE makes it impossible to study the mechanisms and the transient coupling by which the final distributions are established. The QSS Assumption is specifically removed in this study so that the ERE can be solved completely for the early transient characteristics of the plasma decay. GRA

N76-30079# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROBES IN A PLASMA FROM A GAS DYNAMIC POINT OF VIEW WITH APPLICATION TO THE PROBLEM OF SATELLITE CHARGING Environmental Research Papers
H. E. Moses 6 Jan. 1976 16 p refs
(AF Proj. 7635)
(AD-A021489; AFCRL-TR-76-0005; AFCRL-ERP-545) Avail: NTIS CSCL 20/9

Probe theory for probes in a plasma usually involve a kinetic theory approach. In the present report, the author uses gas dynamics (that is, continuum theory) as an approach to probe theory. Simpler expressions are obtained than in kinetic theory approaches. Application is made to the theory of satellite charging at various altitudes. GRA

N76-30080# Naval Research Lab., Washington, D.C.
A LASER INTERFEROMETER FOR THE NRL SEEBIE BEAM-PLASMA INTERACTION EXPERIMENT
David N. Spector Feb. 1976 23 p refs
(NRL Proj. H02-28; RR0110941)
(AD-A021504; NRL-MR-3214) Avail: NTIS CSCL 20/9

Details are given for an interferometer operating at 10.6 micrometers, capable of measuring electron densities in the 10 to the 14th power cu cm to 10 to 16th power cu cm range, constructed for use on the NRL SEEBIE Beam-Plasma Interaction Experiment. In its present form the instrument will provide time dependent, spatially integrated electron density profiles with a minimum detectable value of the integral of (n sub e) ddl = 1.06 X 10 to the 15th power/sq cm. GRA

N76-30081# Rochester Univ., N.Y. Lab. for Laser Energetics.
SPATIAL RESOLUTION OF LASER PRODUCED PLASMAS WITH X-RAY CRYSTALS
B. Yaakobi, T. Bristow, and A. Hauer Mar. 1975 11 p refs
(Contracts N00014-72-C-0046; N00014-67-A-0398-0017; Grant DAHC04-74-G-0236)
(AD-A022042; Rept-28) Avail: NTIS CSCL 20/9

X-ray spectra taken with good quality flat crystals can yield spatial resolution of small plasma sources at the expense of spectral resolution. 40 micrometer spatial resolution of a laser-produced aluminum plasma was obtained using lines of wavelength about 6A. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-30082 Oregon Univ., Eugene.
THE ENERGY LEVELS OF BLOCH ELECTRONS IN A MAGNETIC FIELD Ph.D. Thesis
Douglas Richard Hofstadter 1975 151 p
Avail: Univ. Microfilms Order No. 76-15038

The energy function defining a Bloch-band in a simple model of a two-dimensional crystal is transformed, via the substitution of an operator for the crystal momentum, into an effective Hamiltonian representing the crystal in a uniform magnetic field. The Schrodinger equation for this Hamiltonian turned out to be a difference equation, and a matrix method of solving for its eigenvalues is shown. It is seen that the most appropriate measure of field strength is obtained by dividing the amount of magnetic flux passing through a crystal lattice cell by a flux quantum, which yields a dimensionless quantity. A dichotomy between rational and irrational values of this quantity was observed. Computer calculations of the eigenvalue spectrum for various rational values of the field-parameter are described. It is shown that a physically reasonable spectrum emerges when an averaging-process over values of the magnetic field in an interval is used. Comments are offered on the nature of the wave-functions in rational and irrational cases, and a discussion is given of possible experimental tests of the findings. Dissert. Abstr.

N76-30083*# Hampton Inst., Va. Dept. of Physical Sciences.
MOSSBAUER EFFECT IN THE ION-IMPLANTED IRON-CARBON ALLOYS Final Report, 1 Jan. 1975 - 30 Jun. 1976
Kwang S. Han 30 Jun. 1976 31 p refs
(Grant NGR-47-020-008)
(NASA-CR-148577) Avail: NTIS HC $4.00 CSCL 20L

The concentration dependence of Mossbauer effect in four carbon ion-implanted iron absorbers, which contain carbon as the solute atoms, has been investigated over the range of concentration 0.05 through 1 atomic percent. The specimens were prepared by implanting carbon atoms on each reference iron foil with four different bombarding energies of 250 keV, 160 keV, 140 keV and 80 keV, respectively. Thus, the specimen contains a uniform dosage of carbon atoms which penetrated up to 3,000 A depth of the reference iron. In the measurement of Mossbauer spectra, the backscattering conversion electron counting geometry was used. Typical results of Mossbauer parameters of iron-carbon alloys show that the isomer shift, quadrupole shift, the effective hyperfine splitting of Fe-57, and the intensity ratio exhibit a large variation with the increase of carbon concentration in the environment of iron atoms. Author

N76-30084*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GERMANIUM COATED MICROBRIDGE AND METHOD Patent Application
Louis B. Holdeman and Palmer N. Peters, inventors (to NASA) (NAS-NRC) Filed 13 Aug. 1976 14 p
(NASA-Case-MFS-23274-1; US-Patent-Appl-SN-714158) Avail: NTIS HC $3.50 CSCL 20L

A germanium coated microbridge using a Josephson junction that may be used in superconductive quantum interference devices was described. A pair of spaced layers of superconductive material are connected by a weak link bridge to establish an electrical junction. The superconductive layers and bridge are coated with a semiconductor material shunting the bridge at room temperatures to prevent the destruction of the device by minute electrical currents while the coating acts as a dielectric permitting normal electrical behavior of the microbridge at cryogenic temperatures. This eliminates the elaborate protection measures so far utilized. NASA

N76-30085# Bendix Corp., Kansas City, Kans.
SURFACE EFFECTS ON SEMICONDUCTORS Final Report
E. L. Rauch Jan. 1976 33 p refs
(Contract AT(29-1)-613)
(BDX-613-1468) Avail: NTIS HC $4.00

Semiconductor bi-polar and field-effect transistors were contaminated with sodium ions, subjected to high temperature reverse bias, measured electrically, and examined internally to study the effects of inversion, depletion, and accumulation in crystalline silicon. This study was terminated because of the inability to induce electrical degradation through surface contamination at a level consistently high enough to permit statistically valid correlations and conclusions. Author (ERA)

N76-30086# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPARISON OF GROUP 4 AND 6 DOPING BY IMPLANTATION IN GaAs
D. Eirug Davies, J. K. Kennedy, and C. E. Ludington 5 Mar. 1975 7 p refs Submitted for publication
(AD-A017147/0; AFCRL-TR-75-0559) Avail: NTIS HC $3.50 CSCL 20/12

Factors important in attaining higher n-type conductivity on implanting GaAs have been investigated. These are reflected in a comparison of group 4 and 6 dopants where the difference in behavior can be ascribed to the different sublattice occupation. The importance of Ga outdiffusion with SiO2 encapsulated layers is seen on incorporating Ga within the oxide prior to initiating any heat treatment. For sulfur, the electrical activity is doubled by the presence of the oxide gallium. Such an oxide is detrimental for implanted Si+ layers and indicates that some Ga outdiffusion is desirable. Presumably the same applies and inadvertently occurs with the traditionally simpler p-type implants. Author (GRA)

N76-30087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WHEN THICKNESS IS MEASURED IN ATOMS
A. Valentinov 10 Feb. 1976 11 p Transl. into ENGLISH from Sotsialisticheskaya Industriya (USSR), 8 Aug. 1975 p 4
(AD-A021349; FTD-IDRSI-0116-76) Avail: NTIS CSCL 20/12

Discusses thin film devices. GRA

N76-30088# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECTS OF GAMMA RAY IRRADIATION ON HCl OXIDES Ph.D. Thesis
James N. McGinn Jan. 1976 87 p refs
(AF Proj. 5519)
(AD-A021779; RADC-TR-75-316) Avail: NTIS CSCL 20/12

Silicon dioxide films grown in the presence of controlled amounts of gaseous HCl and O2 at 1125 C have been irradiated by gamma rays from a Cobalt-60 gamma source, up to total dose levels of 1,000,000 rad (Si). The mole percentage ratios of HCl/O2 used during the gate oxide formation were '0', 1, 4, and 6 percent, where the '0' percent oxides represented those oxides grown in pure oxygen following tube cleaning by a mixture of HCl and O2. The effects of irradiation on these oxides as a function of the mole percentage ratios HCl/O2 introduced during oxide formation have been monitored for various gate bias and radiation dose levels. It has been shown that the addition of HCl gas to the oxidizing ambient alters the structure of the resulting oxide in such a way as to increase the number of hole trapping sites available during irradiation. The magnitude of the hole traps formed in the oxide increased as the mole percentage ratio HCl/O2 increased. It has also been observed that, in general, the number of radiation-induced surface states increased as the mole percentage ratio HCl/O2 increased. This is attributed primarily to the breaking of Si-H bonds that were formed during oxide formation. Author (GRA)

N76-30089# Rockwell International Corp., Anaheim, Calif.
INVESTIGATION OF DEFECTS AND IMPURITIES IN SILICON-ON-SAPPHIRE Technical Report, 15 Jan. - 15 Jul. 1975
John L. Peel and Michael D. Barry Jul. 1975 36 p refs
(Contract F19628-75-C-0108; AF Proj. 672A)
(AD-A021905; C75-633/501; AFCRL-TR-75-0413) Avail: NTIS CSCL 20/12

This report covers the first six months work on a program to investigate the effects of defects and impurities in sapphire substrates and SOS material. The work to date has been directed

to identifying the types and quantities of defects and impurities in the samples of material provided by selected vendors. Experiments utilizing chemical surface etch techniques and X-ray topography were performed to identify structural defects in the sapphire substrate material. An Ion Microprobe Mass Analyzer was used to make a detailed elemental analysis of the SOS materials identifying the type and concentrations of impurities present in various samples. Author (GRA)

N76-30090# Hughes Research Labs., Malibu, Calif.
CHEMISTRY OF HALIDE WINDOW GROWTH Final Technical Report, 1 Apr. 1974 - 30 Sep. 1975
R. C. Pastor and H. V. Winston Wright-Patterson AFB, Ohio AFML Feb. 1976 75 p refs
(Contract F33615-74-C-5115; ARPA Order 2612)
(AD-A021326; AFML-TR-75-217) Avail: NTIS CSCL 20/2

The chemistry of reactive atmosphere processing (RAP) for the growth of crystals of chlorides, bromides, and halides was studied. The purity and freedom from extrinsic absorption obtained by RAP are important in the application of halides as optical elements in high power lasers. The prototype of RAP is CCl4 in the growth of KCl; it reacts directly with water to scavenge out all traces of this contaminant and pyrolyzes with the formation of nascent halogen to react rapidly with hydroxide ions in the melt. The approach with the bromides and fluorides has been to seek RAP agents which simulate the behavior of CCl4 with KCl. On the basis of its hydrolysis behavior, CH2 Br2/He was used as the RAP agent for KBr. This has consistently yielded material with a 10.6 micrometer bulk absorption coefficient of 1/.0002 cm, an order of magnitude below that of non-RAP KBr. Further improvement is possible. In addition, it was found that the minimum-melting solid solution of NaBr and KBr prepared under RAP conditions does not retain phase homogeneity below the melting point, making it impossible to grow single crystals of this material. Work on KCl toward problems associated with the scale up of RAP to produce KCl crystals of greater than 10-cm diameter. Hydrogen fluoride, proviously used alone as a RAP agent for fluoride crystal growth, is fast acting but does not achieve a low RAP index, P(H2O)/P(HF). Supplementing it with a fluorocarbon an improved transparency with CF4 admixtures was achieved. GRA

N76-30091# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
RESEARCH ON NONLINEAR AND INTEGRATED OPTICAL MATERIALS Final Report, 1 Jul. 1974 - 30 Jun. 1975
Yoon Soo Park Jun. 1975 26 p refs
(AF Proj. 7885)
(AD-A022047; ARL-75-0199) Avail: NTIS CSCL 20/12

The capability of providing quality ZnSe oriented crystals for substrate material and of producing planar and channel waveguides by diffusion or ion-implantation techniques in this material has been demonstrated. Zinc telluride has likewise been shown to be a useful material for optical waveguide fabrication. The large electrooptic coupling coefficients of these semiconductors are attractive for active devices in the field of integrated optical circuits. The growth, analysis and characterization through an understanding of the electrical and optical properties of the I-III-VI sub 2 semiconductors with chalcopyrite structure have aided in the development of the potential exhibited by these materials for nonlinear optics applications. Junction diode fabrication and photovoltaic detection in the near infrared has been demonstrated in CuInSe2 crystals. GRA

N76-30092# California Univ., Irvine. Dept. of Physics.
RAMAN SCATTERING SELECTION RULES FOR JAHN-TELLER SYSTEMS
E. Mulazzi and N. Terzi Sep. 1975 8 p refs
(Contract N00014-69-A-0200-9003; NR Proj. 392-001)
(AD-A021194) Avail: NTIS CSCL 20/12

Selection rules are given on the phonon symmetries involved in the first-order Raman scattering spectra for Jahn-Teller systems. GRA

N76-30093# California Univ., Irvine. Dept. of Physics.
BREAKDOWN OF SYMMETRY SELECTION RULES FOR DEFECT INDUCED RAMAN SCATTERING Interim Report
E. Mulazzi and M. F. Bishop Dec. 1975 9 p refs
(Contract N00014-69-A-0200-9003; Grant AF-AFOSR-2887-76; NR Proj. 392-001; AF Proj. 9763)
(AD-A021196; Rept-75-49) Avail: NTIS CSCL 20/12

Theoretical results are presented which prove the breakdown of the usual selection rules for first order Raman scattering in resonance with an electronic transition of a localized defect from a degenerate ground state to degenerate excited electronic states which have a dynamic Jahn Teller effect. The theory is illustrated by applying it to the particular case of the F center in CsF. GRA

N76-30094# California Univ., Irvine. Dept. of Physics.
BREAKDOWN OF SYMMETRY SELECTION RULES FOR DEFECT INDUCED RAMAN SCATTERING
E. Mulazzi Mar. 1975 9 p refs
(Contract N00014-69-A-0200-9003; NR Proj. 392-001)
(AD-A021195) Avail: NTIS CSCL 20/12

The theoretical results for the breakdown of the symmetry selection rules for defect-induced Raman scattering are presented in the case that (1) at least one of the p-like virtual electronic excited states has a strong spin orbit interaction and (2) the Jahn Teller active electron phonon interaction couplings evaluated on this excited state are different from zero. The evaluation of the effect presented here is performed for the Raman scattering from the F center in cesium halides. The author shows that all the densities of phonon states that transform according to the irreducible representations of the point group of the defect site are involved in determining every scattering process in which the incident and scattered light are linearly polarized. GRA

N76-30095# California Univ., Irvine. Dept. of Physics.
RAMAN SCATTERING IN RESONANCE WITH AN OPTICAL TRANSITION OF A JAHN TELLER SYSTEM
E. Mulazzi Mar. 1975 9 p refs
(Contract N00014-69-A-0200-9003; NR Proj. 392-001)
(AD-A021193) Avail: NTIS CSCL 20/12

Theoretical results are presented which predict the breakdown of the usual selection rules for the first order Raman scattering in resonance with a localized transition of impurities that exhibit the dynamic Jahn Teller effect in the excited electronic states. GRA

N76-30096# Litton Systems, Inc., Morris Plains, N.J. Airtron Div.
PREPARATION AND SINGLE CRYSTAL GROWTH OF Er, Tm, Ho DOPED YiF4 LASER MATERIALS Annual Summary Report, 1 Jan. 1975 - 31 Oct. 1975
R. Uhrin and R. F. Belt Jan. 1976 44 p refs
(Contract N00014-70-C-0379)
(AD-A021454) Avail: NTIS CSCL 20/5

This report describes a continuation of research efforts to prepare high purity rare earth fluorides, grow single crystals of Er, Ho, and Tm doped YLiF4, and test fabricated laser rods for operation at 2.06 micrometers. All fluorides were prepared by hydrofluorination of 99.99% commercial oxides at 800 - 1,200C in a platinum reactor. Single crystal growth was performed in a N2-HF atmosphere using a top seeded solution method. A platinum furnace was developed along with a diameter control device based on continuous crystal weighing. High quality scatter-free single crystals were grown in 10 - 15 mm diameter and 6 - 10 cm length. Laser rods of (3 x 30) mm size and an axis orientation were finished for several compositions. Both long pulse and Q-switch tests were run on five rods. These indicate that a favorable composition may lead to room temperature operation. Some damage occurred during the Q-switch tests but is not unique to the preparation or growth. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-30097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLES AND CHARTS OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF AMMONIA FOR TEMPERATURES FROM 500 TO 50,000 K.
Ann L. Simmonds, Charles G. Miller, III, and John E. Nealy Washington NASA 1976 259 p refs
(NASA-SP-3099) Avail: NTIS HC $9.00 CSCL 20M

Equilibrium thermodynamic properties for pure ammonia were generated for a range of temperature from 500 to 50,000 K and pressure from 0.01 to 40 MN/sq m and are presented in tabulated and graphical form. Properties include pressure, temperature, density, enthalpy, speed of sound, entropy, molecular-weight ratio, specific heat at constant pressure, specific heat at constant volume, isentropic exponent, and species mole fractions. These properties were calculated by the method which is based on minimization of the Gibbs free energy. The data presented herein are for an 18-species ammonia model. Heats of formation and spectroscopic constants used as input data are presented. Comparison of several thermodynamic properties calculated with the present program and a second computer code is performed for a range of pressure and for temperatures up to 30,000 K. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-30098 General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
EFFECTIVE GOAL DEVELOPMENT, ALLOCATION AND ACCOMPLISHMENT IN AN ENGINEERING ORGANIZATION M.S. Thesis - Drexel Univ.
J. J. Pettus Oct. 1975 55 p refs
(Doc-75SDR-027) Avail: General Electric, Philadelphia, Pennsylvania HC $10.00

The value and essential qualities of goal-setting are examined in relation to the management of a professionally-trained industrial organization of engineers and scientists. The importance of the motivational influence of the human relations factor, particularly as released by the goal-setting method of management, to the success of an engineering organization is emphasized. Author

N76-30099# Committee on the Budget (U.S. House).
NATIONAL SCIENCE FOUNDATION AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PROGRAMS
Washington GPO 1976 101 p refs Hearing before Task Force on Physical Resources of Comm. on the Budget, 94th Congr., 2d Sess., 25 Feb. 1976
(GPO-74-001) Avail: Comm. on the Budget

The budget request for the major activities of general science, space, and technology is considered. The National Science Foundation and National Aeronautics and Space Administration Programs for FY 1977 are summarized and the role of the Federal budget in realizing program goals is discussed. J.M.S.

N76-30100# Little (Arthur D.), Inc., Cambridge, Mass.
FEDERAL FUNDING OF CIVILIAN RESEARCH AND DEVELOPMENT. VOLUME 2: CASE STUDIES Final Report
Feb. 1976 336 p
(Contract NBS-4-35956)
(PB-251683/9; NBS-GCR-ETIP-76-04-Vol-2) Avail: NTIS HC $10.00 CSCL 05A

Federal funding of civilian research and development is examined as an agent of technological change in the private sector. Results indicate that federal funding of civilian research and development should be formulated in the larger context of the complex process of technological innovation. Details of the case studies upon which the findings were based are presented. GRA

N76-30101# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
RESEARCH ON HIGH-LEVEL ADAPTIVE TRAINING SYSTEMS Final Report, Mar. 1974 - Jun. 1975
Wallace Feurzeig, Dan Cohen, George Lukas, and Martin Schiff Nov. 1975 118 p refs
(Contract N61339-74-C-0081)
(AD-A022291; NAVTRAEQUIPC-74-C-0081-6) Avail: NTIS CSCL 05/9

The long term objective of this research is to develop an automated system for instrument flight training which incorporates capabilities for recognizing malfunction patterns and diagnosing the trainee's underlying difficulties. This is necessary because individual trainees experience distinctly different conceptual problems. As the core of such a system, a computer-based instrument flight training simulator, ORLY, was designed. To aid in its development and use, a critical review was made of the literature on adaptive training models and applications. GRA

N76-30102# Naval Ship Engineering Center, Hyattsville, Md.
MANAGEMENT OF RESEARCH AND ENGINEERING SELECTED TOPICS
Jan Paul Hope Mar. 1976 43 p refs Presented at the 13th Ann. Tech. Symp., Arlington, Va., 12 Mar. 1976
(AD-A022310) Avail: NTIS CSCL 05/9

This compendium discusses three topics of interest to managers of scientists and engineers. These three topics are development of scientists and engineers for technical management, performance appraisal of personnel, and means to effectiveness for project managers. The discussion of development of technical personnel for management deals with such areas as candidate selection, problems, and development methods. The discussion of performance appraisal begins with a survey of the relevant literature. This survey also shows the chronological evolution of performance appraisal concepts as they have developed over this years. The discussion of means of effectiveness for project managers begins with the postulation of a knowledge model for the project manager. This knowledge model concept is further developed by identifying and discussion of means of effectiveness for project managers begins with the postulation of a knowledge model for the project manager. This knowledge model concept is further developed by identifying and discussing three categories of knowledge that the project manager should have. A selected bibliography for these three topics is included. GRA

N76-30103# North Carolina State Univ., Raleigh. Operations Research.
THE HUB AND WHEEL SCHEDULING PROBLEMS. PART 2: HOSP, MULTI-PERIOD AND INFINITE HORIZON. PART 3: THE WHEEL OPERATION SCHEDULING PROBLEM
Sanji Arisawa and Salah E. Elmaghraby Oct. 1975 57 p refs
(Grant DAHC04-75-G-0181)
(AD-A022319; NCSU-OR-106-Pt-3; ARO-13119.1-M-Pt-3) Avail: NTIS CSCL 12/2

Part II pursues the analysis of the Hub Operation Scheduling Problem (HOSP) over the finite and infinite horizons. The demand is assumed deterministic and stationary. The minimum fleet size

deduction is made, that satisfies all demands, as well as the optimal schedule (that minimizes lost sales) for a given fleet size. Re-introducing the costs of empties and of delayed sales -- or equivalently, the cost of empties and the gains from shipments, the issues of optimal allocation and optimal schedule is resolved over a finite or infinite horizon. Part III generalizes the above results -- still under the assumptions of deterministic, stationary demands -- first to the case in which each city communicates with its two adjacent cities - the wheel problem -- and then to the general network problem in which each terminal may communicate with any other terminal. GRA

N76-30104# Transportation Systems Center, Cambridge, Mass.
EVALUATION GUIDELINES FOR SERVICE AND METHODS DEMONSTRATION PROJECTS Final Report, Oct. 1974 - Nov. 1975
Carla Heaton, Chester McCall (CACI, Inc., Los Angeles, Calif.), and Robert Waksman Feb. 1976 187 p refs
(PB-251891/8; DOT-TSC-UMTA-76-8; UMTA-MA-06-0049-76-16) Avail: NTIS HC $7.50 CSCL 05A

Evaluation guidelines are given for planning, implementing, and reporting the findings of the evaluation of Service and Methods Demonstration (SMD) projects sponsored by the Urban Mass Transportation Administration (UMTA). The objective of these quidelines is to foster consistency of evaluation philosophy and techniques, and comparability of results so as to improve the output of the UMTA demonstration program. Although these guidelines were prepared specifically for use in evaluating SMD projects, their potential applicability covers the evaluation of any type of transit innovation. GRA

N76-30105# California Univ., Davis. Institute of Ecology.
LAND USE, ENERGY FLOW, AND POLICY MAKING IN SOCIETY Final Report
J. W. Young, J. L. Mitchiner, K. E. F. Watt, C. Ayers, and J. W. Brewer 1 Sep. 1975 394 p refs
(Grant NSF GI-27)
(PB-251537/7; NSF/RA/E-75-048) Avail: NTIS $10.75 CSCL 13B

Interpretations of cause and effect are referred to as 'models', and data extrapolations are referred to as 'simulations', although such terminology is unconventional. The purpose is twofold: first, to provide a methodology for improving computer aids to modeling and to simulation; second, to apply the modeling methodology to the simulation of the use of land and energy in society. The computer aids are specifically designed for the evaluation of policy for land and energy use and not for decision making needed to implement policy. The abstract view of simulation and modeling presented here may initially be difficult to accept. It is, however, useful to conceive of 'understanding of need' as a hypothetical set of cause and effect relationships (models). It is similarly useful to view 'simulation' as a process of extrapolation. GRA

N76-30106# University of Southern Calif., Los Angeles. Social Science Research Inst.
AN OVERVIEW, INTEGRATION, AND EVALUATION OF UTILITY THEORY FOR DECISION ANALYSIS
Detlof VonWinterfeldt 1 Aug. 1975 87 p refs
(Contract N00014-75-C-0487; ARPA Order 2105; NR Proj. 197-021)
(AD-A021497; USC-001597-4-T; SSRI-RR-75-9) Avail: NTIS CSCL 12/1

This report is a survey of the measurement theoretic literature on utility models and assessment. Its purpose is to communicate the concepts of measurement theory to decision analysts who may benefit from the application of measurement theoretic models and methods when solving real world evaluation problems. The report is, first, an inventory and dictionary that classifies, translates, and integrates existing measurement theories; and second, and evaluation of the usefulness of measurement theory as a tool for solving complex decision problems. GRA

N76-30107# Office of the Director of Defense Research and Engineering, Washington, D.C.
AN ANALYSIS OF EXPORT CONTROL OF US TECHNOLOGY: A DOD PERSPECTIVE. A REPORT OF THE DEFENSE SCIENCE BOARD TASK FORCE ON EXPORT OF US TECHNOLOGY
4 Feb. 1976 59 p
(AD-A022029) Avail: NTIS CSCL 05/1

The assessment of selected technologies, their impact on U.S. strategic requirements, transfer mechanisms, and current effectiveness of export control restrictions reinforce the need for export controls and the CoCom agreement as a defense necessity. The effectiveness of these controls for the more critical technologies needs to be improved through definition of policy objectives, simplified criteria, and a more pragmatic approach to the review and approval of license applications. Products of technology not directly of significance to the Department of Defense should be eliminated from controls to enable more effective control of significant items. The findings and principal recommendations of the Task Force are discussed in this report. GRA

N76-29336* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASPECTS OF JOB SCHEDULING
K. Phillips *In its* The Deep Space Network 15 Aug. 1976 p 129-140 refs (For availability see N76-29318 20-12)
CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-30108# Federal Aviation Administration, Washington, D.C.
NATIONAL AIRSPACE SYSTEM MICROFICHE PILOT PROJECT Final Report
Michael J. McCrory Feb. 1976 42 p
(AD-A025091/0; FAA-RD-76-40) Avail: NTIS HC $4.00 CSCL 14E

The original impetus for this project came from the Computer Program production tools task. The approach chosen was to provide microfiche readers and reader/printers to representative test sites. Participants were the New York Air Route Traffic Control Center (ARTCC), Houston ARTCC, and Houston Intercontinental Tower, as well as the Air Traffic Service (AAT500) and Airway Facilities Service (AAF-600) elements located at NAFEC. Eighty thousand pages of documentation were photographed and another eighty thousand pages of computer listings were produced using the computer output to microfiche (COM) technique. The users had mixed reactions to a microfiche documentation system. In general there was acceptance of the printed documentation but resistance to the computer listings on microfiche. The problems encountered in addition to the obvious one of not being able to annotate film can, for the most part, be overcome with better control over the production facility. These problems included poor turn-around time and a need to educate the contractor in the unique aspects of FAA documentation. Author

N76-30109*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
GLOSSARY, ACRONYMS, ABBREVIATIONS: SPACE TRANSPORTATION SYSTEM AND ASSOCIATED PAYLOADS
A. M. Koller, Jr. 30 Jul. 1976 100 p
(NASA-TM-X-74158; KSC-GP-1052-Rev-5) Avail: NTIS HC $5.00 CSCL 05A

A glossary of terms (and definitions) in current usage for the Space Transportation System (STS) and Associated Payloads is presented. Author

N76-30110# Defence Scientific Information Service, Ottawa (Ontario).
AN INFORMATION ANALYSIS CENTRE
Ross B. Harvey Jan. 1976 19 p refs
(AD-A021536; DSIS-TN-75-3) Avail: NTIS CSCL 05/2

The concept of the Information Analysis Centre is developed,

in which a group of customer-users is provided with reliable and timely information in a limited subject area. The conditions which justify an information analysis center, some of its characteristics, some of the steps in organizing a center and the services provided by it to its customers are discussed. The costs of operating the center in terms of the user requirements for its services are considered. GRA

N76-30111# Naval Sea Systems Command, Washington, D.C.
NAVSEA OCEAN ENVIRONMENTAL ACOUSTIC DATA BANK (NAVDAB) IN SUPPORT OF MOBILE SONAR TECHNOLOGY DEVELOPMENT. VOLUME 1: USER'S GUIDE TO RETRIEVAL Final Report
1 Nov. 1975 137 p refs
(SF52552601)
(AD-A020672; NAVSEA-06H1/036-EVA/MOST-2-V-1) Avail: NTIS CSCL 17/1

The Naval Sea Systems Command Ocean Environmental Acoustic Data Bank (NAVDAB) was established to provide a data base of underwater acoustic and associated environmental data. This document provides detailed information on retrieval procedures with brief introductory material on the background, objectives, organization, scope, and modus operandi of NAVDAB. GRA

N76-30112# Naval Aviation Integrated Logistic Support Center, Patuxent River, Md.
OPTIMAL LOADING OF TECHNICAL PUBLICATIONS IN THE MAINTENANCE INFORMATION AUTOMATED RETRIEVAL SYSTEM, MIARS Final Report
Orville R. Wright, Larry D. Barnes, and Margaret J. Cline 30 Jan. 1976 268 p
(AD-A021901; NAILSC-03-31) Avail: NTIS CSCL 05/2

This report presents results of a study of MIARS film cartridges loading methods. The objective was to evaluate various schemes for arranging and sequencing technical publications in the MIARS cartridges and to suggest an optimal method or methods in terms of cost, manageability, and usability. A simulated reload of MIARS film cartridges by publication series, aircraft model application, level of maintenance, and security classification was performed using a sophisticated, general-purpose, interactive computing system. The results confirm the feasibility of this method and indicate that loading efficiencies (defined as the percentage of the permissible maximum frame-loading per cartridge actually used) of near 75% can be achieved. It is postulated that the reloading of MIARS film cartridges by publication series, aircraft model application, level of maintenance, and security classification would improve the manageability and enhance the usability of the MIARS while reducing the costs associated with the reproduction and distribution of MIARS film cartridges. The application and effects of the state-of-the-art software technology employed are described in an appendix. GRA

N76-30113# Lane Council of Governments, Eugene, Oreg. USAC Project.
TELECOMMUNICATIONS/DATA MANAGEMENT SYSTEM (TCDMS) DETAIL DESIGN AND DEVELOPMENT INITIAL TASK COMPLETION REPORT. VOLUME 2: DATA MANAGEMENT COMPONENT
Oct. 1974 38 p
(Contract H-2073)
(PB-251887/6; USAC-LCG2-0019-Vol-2) Avail: NTIS HC $4.00 CSCL 13B

This manual is from a USAC series produced by the Regional Information Systems Department of Lane County. It contains a summary of the Data Management Component of TCDMS, and descriptions of each of the processing modules within the component. GRA

N76-30114# Lane Council of Governments, Eugene, Oreg. USAC Project.
TELECOMMUNICATIONS/DATA MANAGEMENT SYSTEM (TCDMS) DETAIL DESIGN INITIAL TASK COMPLETION REPORT. VOLUME 1: TELECOMMUNICATIONS COMPONENT
Oct. 1974 624 p
(Contract H-2073)
(PB-251886/8; USAC-LCG2-000z-Vol-1) Avail: NTIS HC $16.25 CSCL 13B

This manual is from a USAC series produced by the Lane County Regional Information Systems Department. It contains a module by module description of the internal logical structure of the Telecommunications/Data Management System. GRA

N76-30115# Assistant Secretary of Defense (Comptroller), Washington, D. C.
REPORT ON AN EXPERIMENTAL COMPUTER OUTPUT MICROFILM SERVICE CENTER Final Report
Feb. 1976 78 p refs
(AD-A020735) Avail: NTIS CSCL 14/5

COM is a method of printing computer output on microfilm. Technological advances permit computers to process in terms of billionths of a second. But computer output is limited by the speed at which it can be produced in usable form. With the proliferation of computer applications, large amounts of paper reports have been produced, which are often difficult to store, distribute, and use. Researchers and records management specialists sought to develop an alternative to paper -- one which would enable output to keep pace with computer processing speed (reduce the bottleneck at the output point), reduce storage space, and aid retrieval. COM has provided one answer to these problems by merging the capabilities of the computer with microfilm technology. A COM system requires a recorder, a film developer, a film duplicator, and a reader. The COM recorder may be connected directly to the computer for on-line operation, or it may be connected to a magnetic tape unit for off-line operation. COM recorders use several methods to form images on the film from the computer-generated data. The most commonly used method is the cathode ray tube system. This system converts the computer-produced digital data into analog signals and forms human readable images on a phosphorescent screen which is then photographed. It should be noted that the COM process does not require that a paper copy be made as is done to produce conventional microforms. COM forms the image directly on photographic film. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-30116*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PACE: PRICING AND COST ESTIMATING HANDBOOK
R. D. Stewart and J. D. Wright Jul. 1976 105 p
(NASA-TM-X-73325) Avail: NTIS HC $5.50 CSCL 05C

The PACE (Pricing and Cost Estimating) system, its purpose, makeup, use, and capabilities are described. Author

N76-30117*# Kanner (Leo) Associates, Redwood City, Calif.
OPTIMAL CHOICE OF ABSCISSA VALUES FOR LINEAR REGRESSION OF GIVEN COST FUNCTION
Hans Bandemer (Mining Academy of Freiburg) Washington NASA Aug. 1976 17 p ref Transl. into ENGLISH from Mathematische Operationsforschung und Statistik (West Germany), vol. 1, no. 4, 1970 p 297-308
(Contract NASw-2790)
(NASA-TT-F-17178) Avail: NTIS HC $3.50 CSCL 05C

The choice of abscissa values in linear regression, considered as a decision problem, is examined. The case where the choice is associated with given costs and risk can be calculated by means of a given quadratic loss function. Three optimization problems are formulated: (1) minimum costs with bounded risk; (2) minimum risk with bounded costs; (3) minimum sum of costs and risk. The existence of solutions to these by way of the cost function is demonstrated under conditions that are always satisfiable in practice. Alternative theorems are found for the first two problems that appreciably facilitate their solution. Author

N76-30118# Office of Saline Water, Washington, D.C.
A STANDARDIZED PROCEDURE FOR ESTIMATING COSTS

OF SALINE WATER CONVERSION
Mar. 1956 51 p refs
(PB-251888/4; W76-06550; OWRT/S-76-31) Avail: NTIS HC $4.50 CSCL 07A

A standardized procedure is presented for making initial cost estimates for demineralization of saline waters by various processes. Cost estimates are first approximations based on selected costs for investment, fuel and power, with approximations for labor, supervision, maintenance, and other items. The standardized cost estimating procedure is presented in three parts: (1) a summary of the items in tabular form for estimating the costs, (2) a discussion of the many factors contributing to the cost estimating procedure, and (3) an appendix which includes cost estimates for various items of equipment, and analyses of saline waters. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-30119# Colorado State Univ., Fort Collins. Environmental Resources Center.
SYSTEMATIC DESIGN OF LEGAL REGULATIONS FOR OPTIMAL SURFACE-GROUNDWATER USAGE, PHASE 2 Completion Report, 1 Jul. 1973 - 30 Sep. 1975
H. J. Morel-Seytoux, R. A. Young, and G. E. Radosevich Sep. 1975 246 p refs
(Contract DI-14-31-0001-4067)
(PB-251889/2; CER75-76HJM10; W76-06551; OWRT-B-109-COLO(5); Completion-68) Avail: NTIS HC $8.00 CSCL 08H

The design of regulations for integrated management of surface and ground water is a complex and crucial problem in regions of the United States with a dry climate and a paucity of water resources. Analysis of the problem indicated the need to develop a new approach to hydrologic modeling of the interactions between a stream and an alluvial aquifer. This approach conveniently provides the aquifer response to pumping from wells, the aquifer response to seepage flow from the river and the river response to pumping from wells. Several computer programs, operating sequentially, have been developed.
Author (GRA)

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-30120*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MIUS WASTEWATER TECHNOLOGY EVALUATION
Jerry C. Poradek May 1976 127 p refs
(NASA-TM-X-58130; JSC-09304) Avail: NTIS HC $6.00 CSCL 13B

A modular integrated utility system wastewater-treatment process is described. Research in the field of wastewater treatment is reviewed, treatment processes are specified and evaluated, and recommendations for system use are made. The treatment processes evaluated are in the broad categories of preparatory, primary, secondary, and tertiary treatment, physical-chemical processing, dissolved-solids removal, disinfection, sludge processing, and separate systems. Capital, operating, and maineeance costs are estimated, and extensive references are given.
Author

N76-30121# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
PERFORMANCE REQUIREMENTS FOR TURN AND HAZARD WARNING SIGNALS Final Report, 1 Jul. 1974 - 2 Jun. 1975
David V. Post Apr. 1976 125 p refs
(Contract DOT-HS-4-01001)
(PB-252030/2; UM-HSRI-HF-75-5; DOT-HS-801-871) Avail: NTIS HC $5.50 CSCL 13F

Turn and hazard warning signals were evaluated to determine appropriate flasher design parameters. Flash rate, duty cycle, start mode, color, and rear lighting system configuration were evaluated objectively in both day and night conditions. A subjective evaluation of flash rate and duty cycle was also conducted. The relationships between flash rate, duty cycle, nominal voltage maximum light output, and light contrast ratio during voltage on and off phases, were explored. Recommendations were made as to areas of turn signal and/or flasher specification.
Author (GRA)

N76-30122# Commerce Technical Advisory Board, Washington, D.C.
PROCEEDINGS OF THE EAST-WEST TECHNOLOGICAL TRADE SYMPOSIUM
Betsy Ancker-Johnson, ed. and William C. Holt, ed. Mar. 1976 127 p refs Symp. held at Washington, D. C., 19 Nov. 1975
(PB-251383/6; CTAB-76-2) Avail: NTIS HC $6.00 CSCL 05C

This document consists of the edited transcript from a Department of Commerce symposium held in November, 1975, on the subject of technology trade with the centrally planned economies. Government officials gave an overview of East-West technological trade in terms of trading volume, export controls, and foreign policy. A panel of experts discussed problems and benefits associated with selling American technology, such as creating foreign competition, loss of market share, export of jobs, pricing levels, and economic ramifications. A second panel discussed potential opportunities for the transfer of Soviet computer, energy, and metallurgy technologies to the United States. Case histories of American company dealings with the People's Republic of China were given. GRA

N76-30123# Pennsylvania Transportation Inst., University Park.
THE ROLE OF SUBSTATE REGIONS IN TRANSPORTATION PLANNING, PROGRAMMING, AND BUDGETING Interim Report, 1 Jul. 1974 - 1 Jan. 1975
Thomas D. Larson, Irving Hand, and Theodore H. Poister Jan. 1975 295 p refs Sponsored in part by the Federal Highway Admin.
(Contract PENNDOT-52723)
(PB-251061/8; PTI-7501) Avail: NTIS HC $9.25; also available from NTIS $20.00/set of 3 reports as PB-251059-SET CSCL 13B

The project has two primary purposes: (1) the formulation of alternative concepts for substate regions and regional organizations as a basis for transportation planning, programming, and budgeting; (2) the preparation of draft legislation to implement substate regions and regional organizations in Pennsylvania.GRA

N76-30124# Pennsylvania Transportation Inst., University Park.
THE ROLE OF SUBSTATE REGIONS IN TRANSPORTATION PLANNING, PROGRAMMING, AND BUDGETING Final Report, 1 Jul. 1974 - 15 Dec. 1975
Thomas D. Larson, Irving Hand, and Theodore H. Poister Sep. 1975 270 p refs Sponsored in part by the Federal Highway Administration.
(Contract PENNDOT-52723)
(PB-251062/2; PTI-7521) Avail: NTIS HC $9.00; also available from NTIS $20.00/set of 3 reports as PB-251059-SET CSCL 13B

Contents: History and experience of substate regionalism; Overview of Pennsylvania's transportation planning, programming, and budgeting process; Proposed transportation planning, programming, and budgeting; Proposed organization structure; Implementation and draft legislation. GRA

88 SPACE SCIENCES (GENERAL)

N76-30125# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN. VOLUME 11, NUMBER 4, FOURTH QUARTER 1974 Special Reports
Anne L. Carrigan Mar. 1975 188 p refs
(AD-A022358; AFCRL-TR-75-0160; AFCRL-SR-190) Avail: NTIS CSCL 03/2

This report contains AFCRL contract and inhouse data reported from sites throughout the world. The following types of data are presented: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for October, November, and December 1974.
GRA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-30126*# Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
ORBITAL CHANGES OF THE GASEOUS RING AROUND B SUB e STARS
Su-Shu Huang [1976] 26 p refs
(Grant NGL-14-007-041)
(NASA-CR-148563) Avail: NTIS HC $4.00 CSCL 03A

In order to understand the seemingly erratic V/R variations and radial velocity curves of emission edges and central absorption of some Be stars, a theory is advanced to explain the changes of structure of the gaseous ring around these stars. The theory is based on the interaction between the existing ring and the newly ejected matter from the star. It shows that the structural change of the ring is completely controlled by the angular momentum input factor and the dissipation factor. In light of this understanding, the observed results of beta Mon and Pi Aqr. are interpreted.
Author

N76-30127*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN INVESTIGATION OF THE OPTIMIZATION OF PARAMETERS AFFECTING THE IMPLEMENTATION OF FOURIER TRANSFORM SPECTROSCOPY AT 20-500 MICRON FROM THE C-141 AIRBORNE INFRARED OBSERVATORY
Rodger I. Thompson (Arizona Univ.) and Edwin F. Erickson Aug. 1976 18 p
(NASA-TM-X-73159; A-6702) Avail: NTIS HC $3.50 CSCL 14B

A program for 20-500 micron spectroscopy from the NASA flying C141 infrared observatory is being carried out with a Michelson interferometer. The parameters affecting the performance of the instrument are studied and an optimal configuration for high performance on the C-141 aircraft is recommended. As each parameter is discussed the relative merits of the two modes of mirror motion (rapid scan or step and integrate) are presented.
Author

N76-30128# High Altitude Observatory, Boulder, Colo.
A NON-LTE MODEL STELLAR ATMOSPHERE COMPUTER PROGRAM
Dimitri Mihalas, J. N. Heasley, and L. H. Auer (Yale Univ. Observatory, New Haven, Conn.) Feb. 1975 234 p refs
(NCAR-TN/STR-104) Avail: NTIS HC $8.00

A computer program was developed for calculating model atmospheres of early-type stars subject to the constraints of radiative, hydrostatic, and statistical equilibrium, by means of a complete-linearization technique. This program is available through the NCAR High Altitude Observatory's Radiative Transfer Library.
Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-30129# Los Alamos Scientific Lab., N.Mex.
GENERAL NUMERICAL FLUID DYNAMICS ALGORITHM FOR ASTROPHYSICAL APPLICATIONS
H. M. Ruppel and L. D. Cloutman Oct. 1975 15 p refs
(Contract W-7405-eng-36)
(LA-6149-MS) Avail: NTIS HC $4.00

Finite difference simulation of fluid flows under astrophysical conditions is often complicated by factors such as complex gas physics, the occurence of dynamics at widely differing length scales, and the necessity of using implicit difference equations. This report describes a simple, general, and efficient algorithm for solving one-dimensional, spherically symmetric problems using a variation of the ICED-ALE method. A computer code named VEGA has been written based on this algorithm, and the early stages of the collapse of a one-solar mass protostellar cloud are presented as a sample solution.
Author (NSA)

N76-30130# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
STUDY OF SOLAR WIND INTERACTIONS Final Report, 15 Jan. 1973 - 30 Sep. 1975
Alexander J. Dessler Sep. 1975 155 p refs
(Contract F19628-73-C-0120; AF Proj. 8601)
(AD-A018872; AFCRL-TR-75-0543) Avail: NTIS CSCL 03/2

Significant advances were made in understanding of solar wind magnetosphere interactions and the influence of the solar wind on geomagnetic activity. These advances cover a broad range of topics, including empirical studies of the solar wind control of geomagnetic activity, theoretical studies of the coupling of solar wind energy into the magnetosphere, observational and theoretical studies of the dynamics of the plasma sheet and its role in magnetospheric substorms, and investigations of the coupling between the magnetosphere and the ionosphere. As a direct result of this research, a limited capability of predicting geomagnetic activity using parameters measured in the upstream solar wind was developed.
Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-30131* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METEOROID CAPTURE CELL CONSTRUCTION Patent
Herbert A. Zook and Richard W. High, inventors (to NASA) Issued 27 Jul. 1976 4 p Filed 5 Mar. 1974 Supersedes N74-32885 (12 - 22, p 2694)
(NASA-Case-MSC-12423-1; US-Patent-3,971,256; US-Patent-Appl-SN-448320; US-Patent-Class-73-425.2; US-Patent-Class-73-170R; US-Patent-Class-73-432R) Avail: US Patent Office CSCL 03B

A thin membrane covering the open side of a meteoroid capture cell causes an impacting meteoroid to disintegrate as it penetrates the membrane. The capture cell then contains and holds the meteoroid particles for later analysis.
Official Gazette of the U.S. Patent Office

N76-30132*# Kanner (Leo) Associates, Redwood City, Calif.
NUMERICAL MODELING OF CHEMICAL KINETICS PROCESSES IN PLANETARY ATMOSPHERES
Yu. N. Kulikov Washington NASA Aug. 1976 50 p refs Transl. into ENGLISH of "Chislennoye modelirovaniye protsessov khimicheskoy kinetiki v atmosfere 'planety " Moscow, Institute of Sciences, preprint no. 45, 1976 p 1-45

(Contract NASw-2790)
(NASA-TT-F-17183) Avail: NTIS HC $4.00 CSCL 03B

A stable finite difference method incorporating a decomposition operator is formulated for the numerical solution of a nonsteady multiconstituent boundary value diffusion problem, where chemical reactions are involved. Numerical results are given for an aeronomic model of the Martian atmosphere incorporating eddy diffusion. Since theoretical estimates show the observed stability of the Martian atmosphere to CO2, photodissociation can be explained in terms of a relatively simple sequence of chemical reactions without using the hypothesis of an anomalously high rate of turbulent mixing. Author

N76-30133*# Kanner (Leo) Associates, Redwood City, Calif.
PRELIMINARY SCIENTIFIC RESULTS OBTAINED DURING THE FLIGHT OF THE VENERA 9 AND VENERA 10 AUTOMATIC INTERPLANETARY STATIONS
V. I. Moroz and N. N. Krupenio Washington NASA Aug. 1976 58 p Transl. into ENGLISH of "Predvaritelnyye Nauchnyye Rezultaty, Poluchennyye pri Polete Avtomaticheskikh Mezhplanetnykh Stantsiy Venera-9 i Venera-10" Rept. PR-278 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-60
(Contract NASw-2790)
(NASA-TT-F-17129; PR-278) Avail: NTIS HC $4.50 CSCL 03B

Brief reports are given on the exploration of Venusian atmosphere and surface terrain by Venera 9 and Venera 10 interplanetary automatic stations reaching Venus in October 1975. Two descent modules soft-landed on the surface of the planet, and two artificial satellites went into planetary orbits. Meteorological characteristics, optical properties of Venusian cloud covers, and surficial physical and geomorphological properties were investigated. Also explored was the near-planetary magnetic field, the night and day ionospheres, and cloud particle size at different altitudes above the planet. Author

N76-29824* Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
MULTIPLE SCATTERING IN PLANETARY ATMOSPHERES
William M. Irvine *In* AGARD Opt. Propagation in the Atmosphere May 1976 11 p refs (For availability see N76-29815 20-46)
(Grant NGL-22-010-023)
CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-30134*# Stanford Univ., Calif. Inst. for Plasma Research.
HISTORY OF SOLAR-TERRESTRIAL RELATIONS AS DEDUCED FROM SPACECRAFT AND GEOMAGNETIC DATA: SOLAR M REGIONS
John M. Wilcox Jun. 1976 15 p refs
(Grants NGR-05-020-559; NSF ATM-74-19007; NSF DES-75-15664; Contract N00014-76-C-0207)
(NASA-CR-148565; SU-IPR-665) Avail: NTIS HC $3.50 CSCL 03B

This brief history is organized around the long problem of the solar M region, i.e. the structure on the sun that is responsible for recurrent geomagnetic disturbances. Author

N76-30135# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MOTIONS IN THE SOLAR ATMOSPHERE Scientific Interim Report
Jacques M. Beckers and Richard C. Canfield 18 Nov. 1975 84 p refs Presented at the Intern. Colloq. on Phys. of Motions in Stellar Atmospheres, Nice, Sep. 1975
(AF Proj. 7649)
(AD-A021955; AFCRL-TR-75-0592; AFCRL-ERP-540) Avail: NTIS CSCL 03/2

The report presents two papers on observational evidence for large and small scale motions in the solar atmosphere. GRA

N76-30136# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SATELLITE MEASUREMENTS OF SOLAR UV DURING 1974 Interim Report
James E. Manson 6 Jan. 1976 41 p refs
(AF Proj. 6688)
(AD-A021490; AFCRL-TR-76-0006; AFCRL-ERP-546) Avail: NTIS CSCL 04/1

The progress of the work on the measurement of solar extreme ultraviolet radiation between 142 A and 1850 A by use of the AFCRL experiment on the Atmosphere Explorer-C satellite is presented in this report. The results at short wavelength (less than 200 A) and long wavelength (greater than 1500 A) are emphasized. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-30137# California Univ., Berkeley. Lawrence Berkeley Lab.
OBSERVATION OF THE SUBMILLIMETER COSMIC BACKGROUND SPECTRUM
D. P. Woody 13 Nov. 1975 155 p refs
(Contract W-7405-eng-48)
(LBL-4188) Avail: NTIS HC $6.75

An experimental measurement of the spectrum of the submillimeter cosmic background radiation is described. The experiment consists of measuring the night sky emission at an altitude of 39 km, correcting for the atmospheric molecular line emission, and placing limits on the contamination from sources of continuum radiation such as the apparatus itself and the earth. The observations were made on 24 July 1974 using a fully calibrated liquid-helium-cooled balloon-borne spectrophotometer. Important features of the apparatus include a cooled antenna, a polarizing interferometer, and a germanium bolometric detector. The characterization of the spectrophotometer includes the large angle response and emission of the antenna. The calibration of the instrument and corrections to the observed sky spectrum are based on measurements made during the flight. A simple model of the molecular line emission was used to determine the atmospheric contribution. A 3 K black body is examined and the Big Bang cosmological theory is discussed.
Author (NSA)

N76-30138# Commissariat a l'Energie Atomique, Saclay (France).
COMPOSITION OF COSMIC RAYS AT 10-10 TO 10-13 eV/NUCLEUS
E. Juliusson 1975 6 p Presented at the 14th Intern. Cosmic Ray Conf., Munich, 15-29 Aug. 1975
(CEA-CONF-3091; Conf-750805-11) Avail: ERDA Depository Libraries HC $4.00

The nuclear composition of the cosmic rays around 10 to the 10th power to 10 to the 13th power eV total energy per nucleus has been calculated from recent counter measurements. The abundance of iron in the highest energy range is comparable to the abundance of protons and alpha particles, and increasing with energy. If this trend continues, the highest energy airshower events recorded are caused mostly by iron nuclei. Author (NSA)

N76-30139# Commissariat a l'Energie Atomique, Saclay (France).
CL-36 AND THE AGE OF THE COSMIC RAYS
M. Casse, P. Goret, and S. Regnier 1975 5 p refs Presented at the 14th Intern. Cosmic Ray Conf., Munich, 15-29 Aug. 1975
(CEA-CONF-3082; Conf-750805-17) Avail: ERDA Depository Libraries HC $4.00

An attempt is made to use the radioactive isotope Cl-36 as a time reference for the propagation of cosmic rays. New measurements of the production cross section of Cl-36 in Ti and Fe at 24 GeV will be presented. A critical analysis of the cross sections leads to an estimate of the ratio Cl-36/Cl =

0.030 + or - 0.007 in the arriving cosmic rays. The comparison between the expected abundance of Cl in the arriving cosmic rays and the observations tend to support the decay of Cl-36. The inferred cosmic ray confinement time is about 1 million years. Author (NSA)

N76-30140# Commissariat a l'Energie Atomique, Saclay (France).
SOURCE COMPOSITION OF COSMIC RAYS AT HIGH ENERGY
E. Juliusson, C. J. Cesarsky, M. Meneguzzi, and M. Casse 1975 6 p refs Presented at the 14th Intern. Cosmic Ray Conf., Munich, West Germany, 15-29 Aug., 1975
(CEA-CONF-3086; Conf-750805-13) Avail: ERDA Depository Libraries HC $4.00

The source composition of the cosmic ray is usually calculated at an energy of a few GeV per nucleon. Recent measurements have however indicated that the source composition may be energy dependent. In order to give a quantitative answer to this question the source composition at 50 GeV/ nucleon was calculated using an exponential distribution of pathlengths and in the slab approximation. The results obtained at high energy agree very well with the source composition obtained at lower energies, except the abundance of carbon which is significantly lower than the generally accepted value of low energies.
Author (NSA)

N76-30141# Commissariat a l'Energie Atomique, Saclay (France).
POSITION AND ANTIPROTON ABUNDANCES AS A TEST FOR COSMIC RAY PROPAGATION MODELS
M. Lachieze-Rey and C. J. Cesarsky 1975 6 p refs Presented at 14th Intern. Cosmic Ray Conf., Munich, West Germany, 15-29 Aug. 1975
(CEA-CONF-3081; Conf-750805-18) Avail: ERDA Depository Libraries HC $4.00

The observed variations with energy of the ratio L/M for cosmic rays with energy in the range 1 to 100 GeV/nucl. are well accounted for by three kinds of models: cosmic rays are trapped in the galaxy, where their mean path length is energy dependent; cosmic rays are trapped in their sources, and escape from them in an energy dependent fashion. The mean galactic path length is energy independent; high energy cosmic rays spend less time in dense clouds than low energy cosmic rays. The positron and antiproton fluxes predicted by these models are discussed. Author (NSA)

N76-30142# Commissariat a l'Energie Atomique, Saclay (France).
TIME DELAY BETWEEN THE NUCLEOSYNTHESIS OF COSMIC RAYS AND THEIR ACCELERATION TO RELATIVISTIC ENERGIES
A. Soutoul, M. Casse, and E. Juliusson 1975 4 p refs Presented at 14th Intern. Cosmic Ray Conf., Munich, 15 Aug. 1975
(CEA-CONF-3080; Conf-750805-19) Avail: ERDA Depository Libraries HC $4.00

The time delay sigma(t) between the nucleosynthesis of the elements observed in the cosmic rays and the onset of their acceleration is of critical importance for the discussion of the origin of the cosmic radiation and will affect its composition. The presence of iron group nuclei in the galaxy is believed to be mainly due to explosive nucleosynthesis. This process does not produce iron directly, but the proton rich progenitors Ni-56 and Ni-57. If these isotopes survive the ejection from the exploding star they decay to their stable isobar. If the cosmic rays are accelerated to relativistic energies quickly after their synthesis, these decay modes are prevented, leading to large differences in the Ni/Fe and Co/Fe ratio in the cosmic rays and the solar system abundances. From existing data on the nickel, cobalt and iron abundances in the cosmic rays it is concluded that more than a few weeks and most likely more than a year elapses between the synthesis of the cosmic ray nuclei and their acceleration. Author (NSA)

N76-30143# Commissariat a l'Energie Atomique, Saclay (France).
ATOMIC PROPERTIES OF THE ELEMENTS AND COSMIC RAY COMPOSITION AT THE SOURCE
M. Casse, P. Goret, and C. J. Cesarsky 1975 6 p refs Presented at 14th Intern. Cosmic Ray Conf., Munich, West Germany, 15-29 Aug. 1975
(CEA-CONF-3085; Conf-750805-14) Avail: ERDA Depository Libraries HC $4.00

Possible correlations between the abundances of cosmic rays at the source and the solar system abundances are discussed. It is shown that cosmic ray source abundances could be explained if the particles are accelerated to injection energies in a dilute, moderately hot plasma, from which they escape in a rigidity dependent fashion. Author (NSA)

N76-30144# Commissariat a l'Energie Atomique, Saclay (France).
INTERSTELLAR PROPAGATION OF LOW ENERGY COSMIC RAYS
C. J. Cesarsky 1975 5 p refs Presented at the 14th Intern. Cosmic Ray Conf., Munich, 15-29 Aug. 1975.
(CEA-CONF-3084; Conf-750805-15) Avail: ERDA Depository Libraries HC $4.00

Wave particles interactions prevent low energy cosmic rays from propagating at velocities much faster than the Alfven velocity, reducing their range by a factor of order 50. Therefore, supernovae remnants cannot fill the neutral portions of the interstellar medium with 2 MeV cosmic rays. Author (NSA)

N76-30145# Hanford Engineering Development Lab., Richland, Wash.
FUNDAMENTALS OF DISPLACEMENT PRODUCTION IN IRRADIATED METALS
D. G. Doran Sep. 1975 38 p Presented at Seminar on Radiation-Produced Defects and Defect Clusters and their Effects in Metals, Ames, Iowa, 28-30 Sep. 1976
(Contract E(45-1)-2170)
(HEDL-SA-1012; Conf-750952-3) Avail: NTIS HC $5.00

Radioinduced displacement damage in metals is described. Discussions are included on the displacement event itself, calculation of displacement rates in general, the manner in which different types of radiation interact with metals to produce displacements, the similarities and differences in the types of damage produced, the current status of computer simulations of displacement cascades, experimental evidence regarding cascades, and aspects of correlating damage produced by different types of radiation. Author (NSA)

99 GENERAL

N76-30146*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA TECH BRIEFS, 1975
Feb. 1976 82 p
(NASA-SP-5021(16)) Avail: NTIS HC $5.00 CSCL 05B

This index contains abstracts and four indexes--subject, personal author, originating Center, and Tech Brief number--for 1975 Tech Briefs. Author

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